



Project Delivery Network

Roadway Drainage Design QC Checklist

Version
02/05/2014

QC Manager:
UDOT Central Hydraulics Engineer

Introduction

The Project Delivery Network Roadway Drainage Design QC Checklist is to be used with the [UDOT QC/QA Procedures](#). This checklist is a tool to assist the project team in verifying all work is produced with due diligence, using acceptable industry standard techniques, available resources and data, and reasonable decisions by competent professionals. The checklist is a tool and cannot replace the sound judgment and experience of competent professionals. It is the Design Team's responsibility to verify the quality of project documents **before** distribution.

For suggestions or answers to questions please contact:

George Lukes
UDOT Central Preconstruction Standards Engineer
Phone: 801-965-4986 Email: glukes@utah.gov

QC Documentation

Consistently documenting the QC process is an essential step to the QC procedures. The documentation provides the following benefits:

1. It confirms for project teams that each step in the QC process was completed correctly.
2. It confirms for UDOT that the QC procedures are followed consistently by all project teams.
3. It provides the opportunity for all to find ways of improving the QC/QA procedures.

Documentation has always been used by the project team to perform required quality assurance verification and has been maintained by the design team for reference during construction. It has also served as the way for UDOT to perform project audits to verify the design team followed the required QC/QA procedures. Providing this documentation in ProjectWise increases the opportunities to realize the benefits of QC documentation.

UDOT **requires** the Originator to upload all QC documentation for each deliverable into ProjectWise and attribute it as directed by this QC/QA Design Checklist (see *Recommended QC Documentation Table*). Every deliverable and applicable checklist item must have some form of documentation demonstrating the QC was completed. The QC documentation must be uploaded at or before each milestone review package distribution. The QC process is incomplete until all QC documentation is uploaded and attributed correctly.

The following recommendations are provided for creating QC documentation files:

- Provide all QC documentation required to review the QC process.
- Separate or combine QC documentation into files that are logical for the size and complexity of the project. For example, smaller projects can combine multiple disciplines' plan sheets into one QC file while larger projects should maintain separate files.
- Insert the entire final deliverable copy into the file before the QC check prints.
Example: M&P deliverable, M&P check prints
- Collate the plan sheets, specifications, and special provisions so that each sheet and spec. has the deliverable and check print redlines together.
Example: EC-01 deliverable, EC-01 check prints, EC-02 deliverable, EC-02 check prints, etc.

UDOT QC Documentation Recommendations and Instructions

A balance between consistency and flexibility is required to meet the demands of quality control and the variation in project scopes, teams, budgets, and methods. UDOT is not providing a list of requirements for QC documentation to help meet this balance. UDOT is only requiring that the project team provide all QC documentation, upload it to ProjectWise, and attribute it properly.

Recommended QC Documentation and *UDOT QC Instructions* are provided within the checklist to assist project teams, Checkers, and QA reviewers. These recommendations and instructions are given as guidance and are not meant to change the way a project team performs their QC process if the process meets all UDOT requirements. Project teams may adapt the recommendations and instructions as needed or use them to verify their process meets UDOT's requirements. The recommendations and instructions are not and cannot be completely comprehensive so it is necessary for project teams to make some alterations to the recommendations as needed to meet specific project challenges.

The *UDOT QC Instructions* for each checklist item or group of checklist items can be found italicized under the corresponding items followed by the right justified *Recommended QC Documentation*.

Not all checklist items have a recommended QC documentation. The completed checklist serves as the QC documentation for these items. Provide additional documentation when available.

Some checklist items require coordination, acceptance, or approval to be completed. A space has been provided for these items to identify the documentation being provided as evidence of completion.

The **Originator** is responsible to have all their work checked and to provide and upload all documentation. The **Checker** is responsible to complete a thorough check and provide all documentation to the Originator. Complete QC reviews **before** deliverable distribution.

QC Checklist Instructions

It is **required** to complete and upload into ProjectWise all 14 Design QC Checklists unless otherwise noted by the UDOT Project Manager on the Project QC/QA Plan (*see the UDOT QC/QA Procedures for the Project QC/QA Plan form and instructions*). The Checker must verify all items in the checklist are complete and correct for each deliverable listed along with any additional items the Checker deems necessary.

- The checklist items are not to be interpreted as the only items that need to be checked.
- The Checker places his or her name in the space provided at the beginning of the checklist. Fill out one checklist and include all names if multiple Checkers are used for the same deliverable. Place the Checker's initials next to each item they checked. Use the text box to the left of the item number provided in the form for the Checkers' initials unless the item is not applicable.
- Check the checkbox next to each item that has been checked. Place an **NA** in the checkbox or the text box provided to the left of each item number if the item is not applicable to the project. **ALL** items must have check mark or NA.
- Provide documentation demonstrating the action occurred for checklist items that recommend **Approval Documentation, Coordination Documentation, or Acceptance Documentation**. Documentation may be formal communications, emails, meeting notes, phone conversation logs, or other forms that document communication process. Place the file name in the space provided and follow the attributing convention in the Recommended QC Documentation Table.
- Provided at the end of each checklist is an Estimate Review Checklist. Complete and submit this checklist when checking the estimate as well as completing any checkboxes found on the activity checklist.
- A comments sheet is provided at the end of each discipline's checklist for the Originator and Checker to make comments, notes, and clarifications. Only one comment sheet is provided to minimize space and printing when printing the entire checklist. Use this sheet to document and consolidate the QC check comments.
- Each discipline checklist is separated into activity checklists. Complete the activity checklists necessary for the phase of the project. The Recommended QC Documentation table recommends uploading each activity checklist as a separate file. The checklists may be combined, but each

checklist must be included in the file name and attributed properly (example: QC_4U1_4U3_Checklist_dddmmmyy).

- Every checklist item in each section of all required Design QC Checklists (see the Project QC/QA Plan) must be completed. It is unacceptable to address an entire section with a blanket statement or a continuous line through all boxes. Each item must have “NA” next to it even if an entire activity or section is not applicable.
- Previously completed checklists may need to be completed again if, after a milestone, changes were made to elements checked on the previous checklist. Complete the necessary checklist items associated with the changed element and mark “NA” on all other items. Combine these checklists with the existing phase checklist into one file (example: QC_4R1_3R1_Checklist_dddmmmyy).
- Do not recheck items that have been QC checked previously and have not changed or are not affected by a change.

The Originator is required to upload the completed checklist into ProjectWise and attribute it correctly (see *Recommended QC Documentation Table*) once all items are checked and verified. Properly attributed documents can be verified by checking the QC Saved Search folders in ProjectWise.

The following explanations are to aid in completing the QC checklist items:

- A checklist item deemed “complete,” “correct,” or “accurate” does not denote that the item is perfect, but rather that the item satisfies design criteria based on known information, acceptable techniques, and sound judgment.”
- A checklist item deemed “addressed” denotes the item as “reviewed all known concerns and verified the concerns are appropriately mitigated and satisfy design criteria.” Addressed concerns are not necessarily incorporated into the design, but satisfactorily mitigated.
- A checklist item deemed “identified” denotes the item as “an acceptable and economical approach to satisfy design criteria based on known information.”
- A checklist item deemed “verified” denotes the item as “verified the approach/conclusion as acceptable based on known information.”

QC Documentation ProjectWise/Attributing Instructions

ALL QC documentation must be uploaded into ProjectWise and attributed correctly. Please see [UDOT ProjectWise Online Training](#) for more information on ProjectWise and attributing documents.

There are three potential attributing scenarios for all QC documentation in ProjectWise:

1. Not in ProjectWise initially (e.g. scanned documents that will be uploaded/attributed)
2. Already in ProjectWise but either not attributed or attributed incorrectly
3. Already in ProjectWise and correctly attributed for another reason but also in need of a supplemental attribute specifically for QC

No matter how the required documents initially exist, all must be attributed for QC as directed below or the QC documentation is not considered complete as required

It is *required* to properly attribute ALL QC documentation. To assist project teams properly name and attribute each document, the following table *Recommended QC Documentation* provides naming and attributing conventions for all recommended QC documentation. These naming and attributing conventions can be adapted for use with all additional documentation or altered for combining documents. Name a file logically with all elements included in the file and follow the naming and attributing convention if altering or combining files. Remember, the goal of naming and attributing is to make the document searchable by someone not intimately associated with the project.

Recommended QC Documentation

Recommended Documentation	Naming Convention	Document Type Filter	Document Type	Document Subtype	Document Phase***
Maintenance/Preconstruction Site Visit Form*	<i>See form for naming and attributing instructions</i>				
Maintenance Comment Resolution Form*	<i>PIN_CRF_M_mmddyy</i>	Roadway Design	QC/QA +	Comment Resolution	Scopng
Coordination Documentation	<i>PIN_QC_CoordDocID_mmddyy</i>	Hydraulics	QC/QA +	Meeting	Scopng
DDC Redlines	<i>PIN_QC_DDC_mmddyy</i>	Hydraulics	QC/QA +	Design	Scopng
Roadway Drainage Summary Redlines	<i>PIN_QC_DR_Summary_mmddyy</i>	Hydraulics	QC/QA +	Project Documents	Scopng
Checklist 1Q1	<i>PIN_QC_1Q1_Checklist_mmddyy</i>	Hydraulics	QC/QA +	QC Checklist	Scopng
Scoping Comment Resolution Form*	<i>PIN_S_CRF_mmddyy</i>	Roadway Design	QC/QA +	Comment Resolution	GR
Initial Drainage Design Redlines	<i>PIN_QC_DR_Design_GR_mmddyy</i>	Hydraulics	QC/QA +	Design	GR
Geometry Review Engineer's Estimate Redlines*	<i>PIN_QC_Engineer's_Estimate_GR_mmddyy</i>	Roadway Design	QC/QA +	Engineer's Estimate	GR
Checklist 2Q1	<i>PIN_QC_2Q1_Checklist_mmddyy</i>	Hydraulics	QC/QA +	QC Checklist	GR
Coordination Documentation	<i>PIN_QC_CoordDocID_mmddyy</i>	Hydraulics	QC/QA +	Meeting	GR
Initial Irrigation Design Redlines	<i>PIN_QC_IR_Design_GR_mmddyy</i>	Hydraulics	QC/QA +	Design	GR
Geometry Review Engineer's Estimate Redlines*	<i>PIN_QC_Engineer's_Estimate_GR_mmddyy</i>	Roadway Design	QC/QA +	Engineer's Estimate	GR
Checklist 2Q2	<i>PIN_QC_2Q2_Checklist_mmddyy</i>	Hydraulics	QC/QA +	QC Checklist	GR
Geometry Review Comment Resolution Form*	<i>PIN_QC_CRF_GR_mmddyy</i>	Roadway Design	QC/QA +	Comment Resolution	PIH
Preliminary Drainage Sheets Redlines	<i>PIN_QC_DR_PlanSheets_mmddyy</i>	Hydraulics	QC/QA +	Plan Sheet	PIH
Plan-in-Hand Engineer's Estimate Redlines*	<i>PIN_QC_Engineer's_Estimate_PIH_mmddyy</i>	Roadway Design	QC/QA +	Engineer's Estimate	PIH
Checklist 3Q1	<i>PIN_QC_3Q1_Checklist_mmddyy</i>	Hydraulics	QC/QA +	QC Checklist	PIH
Geometry Review Comment Resolution Form*	<i>PIN_QC_CRF_GR_mmddyy</i>	Roadway Design	QC/QA +	Comment Resolution	PIH
Preliminary Irrigation Sheets Redlines	<i>PIN_QC_IR_PlanSheets_PIH_mmddyy</i>	Hydraulics	QC/QA +	Plan Sheet	PIH
Plan-in-Hand Engineer's Estimate Redlines*	<i>PIN_QC_Engineer's_Estimate_PIH_mmddyy</i>	Roadway Design	QC/QA +	Engineer's Estimate	PIH
Checklist 3Q2	<i>PIN_QC_3Q2_Checklist_mmddyy</i>	Hydraulics	QC/QA +	QC Checklist	PIH
Plan-in-Hand Comment Resolution Form*	<i>PIN_QC_CRF_PIH_mmddyy</i>	Roadway Design	QC/QA +	Comment Resolution	PS&E
Drainage/Irrigation Plan Sheets Redlines	<i>PIN_QC_DR/IR_PlanSheets_mmddyy</i>	Hydraulics	QC/QA +	Plan Sheet	PS&E
Summary Sheets Redlines*	<i>PIN_QC_SM_Sheets_mmddyy</i>	Roadway Design	QC/QA +	Plan Sheet	PS&E
Special Provisions Redlines*	<i>PIN_QC_Specs_PSE_mmddyy**</i>	Roadway Design	QC/QA +	Project Documents	PS&E
M&P Redlines*	<i>PIN_QC_MP_mmddyy</i>	Roadway Design	QC/QA +	Project Documents	PS&E
A&D Redlines*	<i>PIN_QC_Accept_Doc_mmddyy</i>	Roadway Design	QC/QA +	Project Documents	PS&E
PS&E Engineer's Estimate Redlines*	<i>PIN_QC_PSE_Engineer's_Estimate_mmddyy</i>	Roadway Design	QC/QA +	Engineer's Estimate	PS&E
Checklist 4Q1	<i>PIN_QC_4Q1Checklist_mmddyy</i>	Hydraulics	QC/QA +	QC Checklist	PS&E

*Files typically combined with other disciplines into one documentation file. Coordinate with the other disciplines that will provide these documents and the Design Leader. If not combined into one project QC file, provide appropriate file name identifiers and attributing.

** Use *Pin_QC_SpecNo_SpecName_mmddyy* when separating spec files; maintain correct attributing.

*** Use the appropriate document phase; this list is given as a guide.

1Q1 Assess Existing Roadway Drainage Conditions

Review existing conditions and develop recommendations for improvements.

References

1. [UDOT Drainage Manual of Instruction](#)
 2. [UDOT Project Delivery Network](#)
 3. [UDOT QC/QA Procedures](#)
 4. [UDOT Practical Design Guide](#)
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Preliminary Drainage Summary

Checker: _____

Date Completed: _____ PIN: _____

1. A field visit was conducted and existing drainage features were inspected.

Verify the drainage designer attended the Maintenance/Preconstruction site visit or other field visit was conducted. Review the documentation of the visit which may include photos, field notes, etc.

Recommended QC Documentation: Maintenance/Preconstruction Site Visit Form

2. The designer coordinated with maintenance and their comments are documented and addressed.

Verify all discipline related comments are documented, addressed, and all actions are implemented. See the Design Leader Checklist 1Y2 for more information on the comment resolution form.

Recommended QC Documentation: Maintenance Comment Resolution Form (M-CRF)

3. Available existing roadway and structures drawings were obtained and reviewed.
4. Coordinated with the survey team to obtain necessary survey data.

Coordination Documentation: _____

5. Coordinated with the local entities to consider their storm water master plan.

Coordination Documentation: _____

6. Drainage Design Criteria (DDC) was created following the guidelines in Drainage Manual of Instruction and the following items are addressed:
 - a. Hydrology
 - b. Roadway Drainage
 - c. Storm Drains
 - d. Culverts
 - e. Under Drains
 - f. Irrigation Systems
 - g. Ditches
 - h. Major Structures (bridges, box culverts, etc.)
 - i. Detention/Retention Ponds
 - j. Clear Zone Design Constraints
 - k. Water Quality

Check the DDC following the UDOT QC/QA Procedures Section 3.4.

Recommended QC Documentation: DDC Redlines

1Q1 Continued

7. The recommended drainage improvements are appropriate and correct.
 - a. Preliminary capacity needs for each drainage facility
 - b. Existing hydraulic facilities suitability to convey calculated flows
 - c. Possible deficiencies due to the proposed project
 - d. Capacity and physical condition of existing facilities
 - e. Approximate size and location of new facilities
8. The cost estimate addresses all recommended drainage improvements with appropriate risk considerations and contingencies.
9. The roadway drainage summary contains all available information, summarized in a clear and concise format, and the following items:
 - a. Location of existing drainage and irrigation facilities and identifies their ownership, size, material, and condition
 - b. Location and nature of recommended improvements
 - c. Priority of recommended improvements
 - d. Construction phasing and limitations considerations
 - e. Environmental commitments and permits required
 - f. Preliminary drainage cost estimate
 - g. Design activities
 - h. Drainage Design Criteria

Check the summary following the UDOT QC/QA Procedures Section 3.4.

Recommended QC Documentation: Roadway Drainage Summary Redlines

2Q1 Develop Initial Roadway Drainage

Develop preliminary roadway drainage

References

1. [UDOT Drainage Manual of Instruction](#)
 2. [UDOT CADD Standards](#)
 3. Preliminary Drainage Summary (1Q1)
 4. [UDOT Project Delivery Network](#)
 5. [UDOT QC/QA Procedures](#)
 6. [Estimate Review Checklist](#)
 7. [UDOT Practical Design Guide](#)
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Initial Drainage Design Layout

Checker: _____

Date Completed: _____ PIN: _____

1. All review and maintenance comments are addressed, incorporations complete, and the comment resolutions sent to the design leader.

Verify all discipline related comments are addressed and all actions are implemented. Verify all comments not retired in previous stages are transferred to the current CRF. See the UDOT QC/QA Procedures section 6.0 for more information.

Recommended QC Documentation: Scoping Comment Resolution Form (S-CRF)

2. Hydrologic methodology is identified with hydrology and flows for each feature.
 - a. Design storm intensity and frequency were correctly determined.
 - b. Time of concentration was correctly determined.
3. All necessary drainage features are identified.
4. Conveyance methods (pipe, ditch, culvert, etc.) are identified.
 - a. Preliminary storage needs are correctly determined.
 - b. Ultimate outfall locations are identified.
5. Detention/retention basin locations are identified.
6. The roadway profile was reviewed by the hydraulic and roadway design teams.
 - a. Potential conflicts are identified.
 - b. Recommended features potentially inside the clear zone or ROW are identified.
7. Initial drainage design layout is ready for distribution.
8. Identified and coordinated all additional survey needs with the survey team.
9. Identified and coordinated all potential utility conflicts with the utility team.
 - a. Requested necessary SUE data for utility conflicts.

2Q1 Continued

- 10. Identified and coordinated potential ROW impacts with the ROW team.
 - a. Requested required easements.

Check the design (on plan sheets or other form) following the UDOT QC/QA Procedures Section 3, including calculations and computer input.

Recommended QC Documentation: Initial Drainage Design Redlines

Preliminary Drainage Cost Estimate

Checker: _____

Date Completed: _____ PIN: _____

- 1. The roadway drainage cost estimate was verified through the Estimate Review Checklist (found at the end of this document).

See the [Estimate Review Checklist](#) for recommended QC documentation and instructions.

Recommended QC Documentation: Geometry Review Engineer's Estimate Redlines

2Q2 Develop Initial Irrigation Design

Layout the initial irrigation design.

References

1. [UDOT Drainage Manual of Instruction](#)
 2. [UDOT CADD Standards](#)
 3. [UDOT Project Delivery Network](#)
 4. [UDOT QC/QA Procedures](#)
 5. [Estimate Review Checklist](#)
 6. [UDOT Practical Design Guide](#)
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Initial Irrigation Design Layout

Checker: _____

Date Completed: _____ PIN: _____

1. The designer met with the Irrigation Company.

Coordination Documentation: _____

2. Existing irrigation system is correctly modeled based on known information.
 - a. Known flow splitting and metering elements are included.
3. Initial pipe sizes and ditch geometry adequately meet known design requirements.
4. Preliminary locations of diversion structures and flow measurement elements are determined and adequately meet known design requirements.
5. Identified and coordinated all additional survey needs with the survey team.
6. Identified and coordinated all potential utility conflicts with the utility team.
 - a. Requested necessary SUE data for utility conflicts.
7. Identified and coordinated potential ROW impacts with the ROW team.
 - a. Requested required easements.

Check the design (on plan sheets or other form) following the UDOT QC/QA Procedures Section 3, including calculations and computer input.

Recommended QC Documentation: Initial Irrigation Design Redlines

Preliminary Irrigation Cost Estimate

Checker: _____

Date Completed: _____ PIN: _____

1. The irrigation cost estimate was verified using the Estimate Review Checklist (found at the end of this document).

See the [Estimate Review Checklist](#) for recommended QC documentation and instructions.

Recommended QC Documentation: Geometry Review Engineer's Estimate Redlines

3Q1 Complete Roadway Drainage Design

Develop the roadway drainage and/or open channel drainage features.

References

1. [UDOT Drainage Manual of Instruction](#)
 2. [UDOT CADD Standards](#)
 3. [UDOT Standard and Supplemental Drawings](#)
 4. [UDOT Plan Sheet Development Standards](#)
 5. [UDOT Project Delivery Network](#)
 6. [UDOT QC/QA Procedures](#)
 7. [Estimate Review Checklist](#)
 8. [UDOT Practical Design Guide](#)
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Roadway Drainage Design

Checker: _____

Date Completed: _____ PIN: _____

1. All review comments are addressed and the comment resolutions sent to the Design Leader.

Verify all discipline related comments are addressed and all actions are implemented. Verify all comments not retired in previous stages are transferred to the current CRF. See the UDOT QC/QA Procedures section 6.0 for more information.

Recommended QC Documentation: Geometry Review Comment Resolution Form (GR-CRF)

1. All revisions based on comments are complete.
2. Hydraulic models of project features were created and calculations for the models are correct.
3. Routing of check flood was performed based on table 7.A-1. (1)
4. The storage facility design adequately meets project requirements:
 - a. Inflow hydrograph developed correctly.
 - b. Storage volume breakout is correctly calculated.
 - c. Grading and depth requirements adequately meet project requirements.
 - d. Outlet locations are appropriate.
 - i. Release rates are appropriately analyzed.
 - ii. Control structures design is adequate.
 - iii. Energy dissipation is appropriately evaluated.
 - e. Provisions for maintenance (such as berms and access ramps) are adequate.
5. Storm inlet design adequately meets design and project requirements.
 - a. Correct design inlet spacing per design criteria.
 - b. Achieves minimum time of concentration (1)
 - c. Achieves maximum access spacing (1)

3Q1 Continued

- d. All sag points and existing drainage nuisances are identified.
 - e. Debris and clogging of storm drain inlet is adequately addressed.
 - f. Correct grate/rim elevations for drainage structures
6. Storm drain design adequately meets design and project requirements.
- a. Minimum and maximum velocities are maintained. (1)
 - b. Minimum pipe sizes are maintained. (1)
 - c. Hydraulic grade lines (HGLs) are one foot or more below the finished grade pavement surface at all times for the design storm.
 - d. Storm drain material selection is appropriate. (1)
 - e. Appropriate energy dissipation needs
 - f. Flood inundation of storm drain system is appropriately analyzed.
 - g. Environmental restrictions of water quality for outfall are met.
 - h. Vertical profiles for pipes and ditches meet project and design requirements.
 - i. Earthwork is correctly calculated.
7. Culvert design adequately meets design and project requirements.
- a. Design storm frequency is appropriate. (1)
 - b. Culvert design limitations are maintained. (1)
 - c. Minimum culvert size maintained.
 - d. Headwall and end-sections placed appropriately. (1)
 - e. Culvert material selection is appropriate. (1)
 - f. Energy dissipation correctly evaluated.
8. All potential utility conflicts with drainage features are identified and coordinated with the utility team.

Check the design following the UDOT QC/QA Procedures Section 3, including calculations and computer input. Combine this check with the preliminary plan sheets check.

Recommended QC Documentation: Preliminary Drainage Sheets Redlines

Preliminary Drainage Plan and Profile Sheets

Checker: _____

Date Completed: _____ PIN: _____

1. All preliminary plan sheets conform to UDOT Plan Sheet Development Standards. (4)
 - a. All sheets are cut appropriately.
 - b. All reference files are properly attached.
 - c. Plan sheet CADD standards are followed and maintained on each sheet.
2. All labels, callouts, and information necessary for a plan-in-hand review of the drainage design are included and correct.
3. Profiles are displayed along the conveyance feature, not the roadway.

Check plans sheets following UDOT QC/QA Procedures Section 3.3. If these plan sheets are combined with others designs (i.e. on the RD sheets) complete the checklist and use the comment sheet to note the file name, location, and attributes.

Recommended QC Documentation: Preliminary Drainage Sheets Redlines

Drainage Cost Estimate

Checker: _____

Date Completed: _____ PIN: _____

1. The roadway drainage cost estimate was verified using the Estimate Review Checklist (found at the end of this document).

See the [Estimate Review Checklist](#) for recommended QC documentation and instructions.

Recommended QC Documentation: Plan-in-Hand Engineer's Estimate Redlines

3Q2 Complete Irrigation Design

Complete the layout of irrigation features.

References

1. [UDOT Drainage Manual of Instruction](#)
 2. [UDOT CADD Standards](#)
 3. [UDOT Standard and Supplemental Drawings](#)
 4. [UDOT Plan Sheet Development Standards](#)
 5. [UDOT Project Delivery Network](#)
 6. [UDOT QC/QA Procedures](#)
 7. [Estimate Review Checklist](#)
 8. [UDOT Practical Design Guide](#)
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Irrigation Design

Checker: _____

Date Completed: _____ PIN: _____

1. All review comments are addressed and the comment resolutions sent to the Design Leader.

Verify all discipline related comments are addressed and all actions are implemented. Verify all comments not retired in previous stages are transferred to the current CRF. See the UDOT QC/QA Procedures section 6.0 for more information.

Recommended QC Documentation: Geometry Review Comment Resolution Form (GR-CRF)

1. All revisions based on comments are complete.
2. Irrigation design meets design and project requirements.
 - a. Appropriately calculated design flow data for both normal and peak flows
 - b. Acceptable hydraulic performance for design flow and operational head
 - c. Correct rim elevations for diversion structures
 - d. Acceptable vertical profile for irrigation pipes and ditches
 - e. All irrigation culverts extend from one ROW boundary to the other.
 - f. Pipe material selection is appropriate.
3. Hydraulic details meet design and project requirements.
 - a. All diversion points are re-established (unless there is written notification for abandonment).
 - b. Flow measurement devices and locations are appropriate.

Check the plan sheets following the UDOT QC/QA Procedures Section 3.3. Combine this check with the preliminary plan and profile sheets check.

Recommended QC Documentation: Irrigation Design Redlines

Preliminary Irrigation Plan and Profile Sheets

Checker: _____

Date Completed: _____ PIN: _____

1. All preliminary plan sheets conform to [UDOT Plan Sheet Development Standards](#)
 - a. All sheets are cut appropriately.
 - b. All reference files are properly attached.
 - c. Plan sheet CADD standards are followed and maintained on each sheet.
2. All labels, callouts, and information necessary for a plan-in-hand review of the drainage design are included and correct.
3. Profiles are displayed along the conveyance feature, not the roadway.

Check plans sheets following UDOT QC/QA Procedures Section 3.3. If these plan sheets are combined with others designs (i.e. on the RD sheets) complete the checklist and use the comment sheet to note the file name, location, and attributes.

Recommended QC Documentation: Preliminary Irrigation Sheets Redlines

Irrigation Cost Estimate

Checker: _____

Date Completed: _____ PIN: _____

1. The irrigation cost estimate was verified using the Estimate Review Checklist (found at the end of this document).

See the [Estimate Review Checklist](#) for recommended QC documentation and instructions.

Recommended QC Documentation: Plan-in-Hand Engineer's Estimate Redlines

4Q1 Complete Drainage/Irrigation Plan Sheets and Documents

Revise the drainage and irrigation designs based on the plan-in-hand review. Complete drainage and irrigation plan set and documents. Finalize the hydraulics report.

References

1. [UDOT Drainage Manual of Instruction](#)
 2. [UDOT Plan Sheet Development Standards](#) (PSDS)
 3. [UDOT CADD Standards](#)
 4. [UDOT Standard and Supplemental Drawings](#)
 5. [UDOT Standard and Supplemental Specifications](#)
 6. [Specification Writer's Guide](#)
 7. [Measurement and Payment Instructions](#)
 8. [Acceptance and Documentation Guide](#)
 9. [UDOT Project Delivery Network](#)
 10. [UDOT QC/QA Procedures](#)
 11. [Estimate Review Checklist](#)
 12. [UDOT Practical Design Guide](#)
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Drainage/Irrigation Plan Sheets

Checker: _____

Date Completed: _____ PIN: _____

1. All review comments are addressed and the comment resolutions sent to the Design Leader.

Verify all discipline related comments are addressed and all actions are implemented. Verify all comments not retired in previous stages are transferred to the current CRF. See the UDOT QC/QA Procedures section 6.0 for more information.

Recommended QC Documentation: Plan-In-Hand Comment Resolution Form (PIH-CRF)

1. All revisions based on comments are complete.
2. All design revisions conform to design standards and meet project requirements (see previous checklist items as needed).
3. All drainage and irrigation plan and profile sheets conform to UDOT plan sheet development standards. (See (2) – General Plan Sheet Requirements)
 - a. PSDS *General Plan Sheet Requirements* are followed. (2)
 - b. Call-out rules are followed.
 - c. All title blocks are filled out correctly.
 - d. Plan Sheet CADD standards are followed and maintained on each sheet.
 - e. All necessary notes, callouts, legends, etc. are included, correct, and neatly organized.
 - f. All pay item callouts match the engineer's estimate pay items.

- 4. **Drainage/Irrigation Plan and Profile Sheets** are complete
 - a. All pipes, culverts, inlets, etc. are identified and correctly numbered.
 - b. All existing and proposed drainage features are correctly identified and labeled.
 - i. Existing water features (river, stream, creek, lake), canals, ditches, and pipes
 - 1. Dimensions and/or cross sections
 - ii. Proposed conveyance methods are correctly identified (pipe, ditch, culvert, etc).
 - 1. Dimensions and/or cross sections
 - 2. Slopes
 - 3. Design flows and velocities
 - 4. Hydraulic grade lines
 - 5. Inflow and outflow elevations
 - 6. Energy dissipation locations and methods
 - iii. Profiles are along the conveyance feature, not the roadway.
 - c. Proposed drainage structure grate/rim elevations are correct.
 - d. All utility conflicts are indicated on both the plan and profile.
- 5. **Detail sheets** are complete (See (2) – Detail Sheet Requirements).
 - a. All necessary details to build the project are included.
 - b. The *PSDS DT Sheet Checklist* items are complete.
 - c. All details are labeled and dimensioned completely and correctly (2).
 - d. All necessary labels, callouts, identifiers, symbols, and notes are provided and correct.

Check design revisions and plan sheets following UDOT QC/QA Procedures Section 3.3. If these plan sheets are combined with others designs (i.e. on the RD sheets) complete the checklist and use the comment sheet to note the file name, location, and attributes.

Recommended QC Documentation: Drainage/Irrigation Plan Sheets Redlines

6. **Summary Sheets** are complete. (See (2) – Summary Sheet Requirements)
- a. The *PSDS Summary Sheet Requirements* are followed and complete.
 - b. UDOT standard summary sheets are used.
 - c. All pay items are included in the summary.
 - d. All quantities are calculated correctly.
 - e. All pay item names, alignment designations, stations, offsets, units, and quantities are correct.
 - f. All summaries are exported from Excel to Microstation and the sheets are updated with the current Excel version.
 - g. All summary items and quantities are entered into PDBS.

Check the summary sheets following the UDOT QC/QA Procedures Section 3.4. Verify the quantities and provide all documentation, including spreadsheet printouts, hand calculations, etc. Provide notes on the QC documentation where necessary to explain the methods and programs used to check quantities and prices.

Recommended QC Documentation: Summary Sheets Redlines

Drainage/Irrigation Project Documents

Checker: _____

Date Completed: _____ PIN: _____

1. The **Special Provisions** are complete. (4)
- a. All special provisions conform to the Specification Writers' Guide (verify using Chapter 11 Checklist). (4)
 - b. A special provision has been created for each non-standard item.
 - c. All general and project specific special provision content is accurate, complete, and does not contain anything unnecessary.

Check Special Provisions following the UDOT QC/QA Procedures Section 3.4.

Recommended QC Documentation: Special Provisions Redlines

2. The **Measurement & Payment** is complete. (5)
- a. All M&P items match pay items exactly.
 - b. For all non-standard pay items, a complete and correct M&P description of all effort and materials is included.
 - c. All units are correct.

Check drainage/irrigation M&P descriptions following the UDOT QC/QA Procedures Section 3.4. The project team may decide the best M&P QC check method (separate redlines for each discipline, completed on one circulated printout, etc.).

Recommended QC Documentation: M&P Redlines

4Q1 Continued

3. The **Acceptance & Documentation** is complete. (6)
 - a. All A&D items match pay items exactly.
 - b. PDDBS was used to generate A&D for all pay items.
 - c. For all non-standard pay items, a complete and correct A&D is included.

Check drainage/irrigation A&D descriptions following the UDOT QC/QA Procedures Section 3.4. The project team may decide the best A&D QC check method (separate redlines for each discipline, completed on one circulated printout, etc.).

Recommended QC Documentation: A&D Redlines

Final Drainage/Irrigation Cost Estimate

Checker: _____

Date Completed: _____ PIN: _____

1. The cost estimate was verified using the Estimate Review Checklist (found at the end of this document).

See the [Estimate Review Checklist](#) for recommended QC documentation and instructions.

Recommended QC Documentation: PS&E Engineer's Estimate Redlines

Estimate Review Checklist

Provide review checklist of all design cost estimates.

References

1. [Estimating – Roadway Design Manual of Instruction](#) (Section 7.19)
 2. [Estimator’s Corner Website](#)
 3. [UDOT Project Delivery Network](#)
 4. Project Development Business System
-

Estimate (applies to every stage for updating the estimate)

Checker: _____

Date Completed: _____ PIN: _____

1. All required bid items are included.
2. All quantities and units are correct.
3. All standard bid items match UDOT standard bid items exactly.
4. Unit prices were estimated using UDOT approved methods (PDDBS, local contractors, etc.).
5. All unit price estimates are documented.
6. Unit prices reflect the following: (1)
 - a. Location
 - b. Inflation
 - c. Quantity of item
 - d. Construction Complexity
 - e. Limitations of operation
 - f. Current bidding environment
 - g. Familiarity of a process
 - h. Time of year for advertising
 - i. Specialty equipment
 - j. Risk to contractor
 - k. Availability of materials
 - l. Construction schedule
7. Lump sum bid prices are used only when appropriate (i.e. unit pricing is too difficult).
8. All lump sum bid prices considered the following:
 - a. Contractor risk due to unknown quantity
 - b. Difficulty in making it a unit price pay item

Additional PS&E Estimate

9. All bid items, quantities, and units match the plan sheet callouts, summary sheets, and M&P exactly.

Check the engineer's estimate following the UDOT QC/QA Procedures Section 3.4. The way the engineer's estimate is QC checked may vary depending upon the project scope and project team. Provide documentation demonstrating that every item and all quantities in the engineer's estimate were QC checked. Provide spreadsheets, hand calculations, notes, etc. as necessary to explain methods, assumptions, etc. Give all engineer's estimate redlines for each project phase to the Design Leader to upload in one file.

Recommended QC Documentation: Engineer's Estimate Redlines

QC Check Comments

Provide comments, methods, assumptions, explanations, file locations, and any other information needed to facilitate the QC check. Print and attach this sheet to the checklist. Upload this sheet with the associated checklist.

PIN: _____ Activity: _____ Deliverable(s): _____

Originator: _____

Checker: _____

Additional Commenter(s): _____