

STATEMENT OF WORK**Irrigation Pipeline (430)****North Dakota**

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These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

DESIGN

Deliverables:

1. Make an initial site visit with the client for the purpose of collecting design information.
2. Prepare and document the design deliverables under the subsection headings shown below. Documentation shall demonstrate that the practice is compatible with other planned and applied practices at the project site. Identify and engage a qualified person to check the design methodology, technical references, plan drawings, and computations for accuracy.
 - a. Narrative Design Report:
 - i. Executive summary (background, applied practices, parties involved, Federal/State programs, cost, etc.).
 - ii. Design objective(s).
 - iii. Design references.
 - iv. Discussion of assumptions and analyses performed under subsection headings shown below.
 - v. Discussion of estimated quantities, material selections, construction methods, and cost.
 - vi. Discussion of design alternatives that were considered.
 - b. Survey:
 - i. A local benchmark control.
 - ii. Topography survey for contour elevations, horizontal alignments, grades, and locations of critical features (approximate property lines, utilities, roads, fences, trees, buildings, etc.).
 - iii. Survey notes, which includes survey points and GPS coordinates obtained by the contractor.
 - c. Soils:
 - i. Identification of all soil map units at and around the site.
 - ii. Soil profile classification down to the trench bottom depth for the purpose of specifying a safe, stable trench, ensuring proper pipe bedding, and estimating the associated excavation quantities. Classification includes Unified Soil Classification (USC), plasticity index, soil moisture, soil stiffness, color, shear strength, etc.
 - iii. Water Table Description. Soil mottling (redoximorphic features), seasonal high water table elevation, apparent water table elevation, and apparent source of water (localized lenses, regional water table, or irrigation-induced water table).
 - iv. Geologic investigation. Depth to shale/bedrock or other root limiting feature, connectivity to water tables.
 - v. Resistivity survey if needed for steel pipeline.
 - d. Structural Analysis:
 - i. Calculations for the span and support of above ground ditch crossings (stability, moments, shears, thermal movement).
 - ii. Calculations for the pipe class and bedding and backfill specifications under road crossings.
 - iii. Pipe deflection calculations.
 - e. Hydraulics:
 - i. System capacity based on (a) peak consumptive crop use, and (b) available water holding capacity.
 - ii. Pipeline capacity based on friction and minor loss calculations.
 - iii. Velocity and surge calculations.

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- iv. Pipe diameter, pressure class, and pipe bedding design and specifications.
 - v. Floatation calculations, e.g., empty pipes surrounded by saturated soils.
 - vi. Thrust block calculations.
 - vii. Air and vacuum relief vent calculations for size and capacity.
 - viii. Pressure relief valve and water control valve design and specifications.
 - f. Estimated Quantities and Cost Estimate:
 - i. Calculations, sketches, and computer output to support estimated quantities for all material and construction components.
 - ii. Item, units, unit cost, estimated total cost for all material and construction components.
 - g. Construction and Material Specifications:
 - i. Applicable base specifications.
 - ii. Items of work and construction details specific to the job.
 - h. Construction Inspection Plan:

NOTE: The objective of the Construction Inspection Plan is to identify critical elements of construction, schedule quality control activities, describe the process for change orders, and document "as-built" construction in such a manner that the engineer-of-record can seal and certify the project as meeting NRCS Practice Standard 430.

 - i. Critical construction and material items that require inspection.
 - ii. Required submission of shop drawings, material specifications, bills of lading, load tickets, etc.
 - iii. Names, titles, and basic qualifications of inspectors who must supervise critical elements of construction.
 - iv. Schedule of critical construction items.
 - v. Safety details and protocol for hazardous operations e.g. trench safety.
 - vi. Establishment of local benchmark control and horizontal and vertical alignments.
 - vii. Construction tolerances for lines, grades, compaction, concrete air/slump/compression, gradations, soundness, etc.
 - viii. Testing protocols for water tightness and pressure.
 - ix. Locations and features that require as-built survey shots and photograph documentation.
 - x. Procedure for authorizing and documenting change orders. All change orders from the plans and specifications must be authorized and documented by the landowner, designer, and NRCS.
 - xi. List of items that must be recorded on "as-built" drawings.
 - i. Operation and Maintenance:
 - i. Critical elements of operation and maintenance.
 - ii. Frequency of inspection.
 - iii. Normal operating range or conditions.
 - iv. Typical problems that may occur.
 - v. Minor maintenance procedures.
 - vi. Contact information for persons or entities that can assist with problems.
3. Plan Drawings:
- a. Cover Sheet:
 - i. Location Map.
 - ii. Estimated Quantities Schedule for all construction and material items.
 - iii. Required permits and easements.
 - iv. Utility notification statement.
 - v. Job Approval Class for each conservation practice.
 - b. Plan View Sheet:
 - i. Location and description of local benchmark control.
 - ii. Horizontal alignments (stationing, deflection angles, horizontal curve data).
 - iii. Location and description of critical land features (buildings, roads, trees, utilities, approximate property lines).

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- iv. Location and description of appurtenances.
- v. Direction of irrigation, beginning and ending of pipeline project.
- vi. Show critical hydraulic information.
- c. Profile View Sheets:
 - i. Existing ground profiles with planned lines and grades of the improvement.
 - ii. Station and elevation flags for all grade breaks, depth of cover, pipeline length, diameter, and classification.
 - iii. Station and elevation and description flags for all appurtenances and inline structures.
 - iv. Vertical curve data (stationing, deflection angles, etc.).
 - v. Soil profile information.
- d. Detail Sheets for Appurtenances:
 - i. Detail sections.
 - ii. Locations and elevation labels.
 - iii. Details of pipeline appurtenances, which include but are not limited to filtering system, control valves, concrete works, dogleg details, pump outs, trench details, etc.
 - iv. Make/model of parts, suppliers, performance ratings, gradations, or other critical information not shown in the specifications.
 - v. Safety details and considerations including but not limited to: Trench safety as required (Reference: OSHA 29 CFR 1926 650-652 Subpart P).

INSTALLATION

Deliverables:

1. Pre-construction conference with the landowner and contractor.
2. Sufficient on-site inspection to ensure that the project is installed according to the plans and specifications--in such a manner that the designer can technically certify construction as meeting the plans, specifications, and Practice Standard 430.
3. Ensure the landowner understands the plans and specifications, and has obtained the required permits and permissions to construct the project.
4. Establish or verify local benchmark control and stake horizontal and vertical alignments.
5. Confirm that the assumptions used in the design are valid.
6. Inspect and document critical elements of construction as described in the Construction Inspection Plan which includes, but is not limited to:
 - a. Verification and approval of shop drawings and material specifications.
 - b. As-built survey of critical grades and elevations, as-built measurements of appurtenances.
 - c. Collection of bills of lading, load tickets, etc.
 - d. As-built photographs of staged construction.
7. Document change orders approved by the landowner and the NRCS.
8. Ensure that proper safety protocols are followed for hazardous operations e.g., trench safety.

CHECK OUT

Deliverables:

1. Conduct a final site inspection to technically certify that the completed construction meets the plans, specifications, and NRCS Practice Standard 430.
2. Prepare an "as-built" set of plans which document construction changes in red-line ink which includes, but is not limited to:
 - a. Actual installed quantities and materials (manufacturer/model/size/schedule/grade/strength) for all material and construction items.
 - b. Final elevations, lines, and grades of Irrigation pipeline features.
3. Assemble shop drawings, material specifications, bills of lading, load tickets.

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4. Assemble test results for earthfill compaction, concrete, etc.
5. Place a certification statement on the as-built plan which states, "To the best of my knowledge, judgment, and belief, this practice was installed in accordance with the plans and specifications and meets NRCS Practice Standard 430 – Irrigation Pipeline."

REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Irrigation Pipeline, 430
- NRCS National Engineering Handbook Parts 600-659
- NRCS Web Soil Survey