



**TYPICAL FSE SCOPE OF WORK
FRP PIPING SYSTEMS
TECHNICAL AND QUALITY ASSURANCE SUPPORT**

(Vendor Performance Design Option)

1. F.E.E.D. CONSULTING SUPPORT

- FEASIBILITY/ CONSTRUCTABILITY REVIEWS (options for burial/aboveground supports/ installation, fabricator products and manufacturing capabilities, piping layout issues)
- MATERIAL SELECTION ASSISTANCE (resin systems, uni-directional reinforcement, etc.)
- DESIGN STRATEGIES (standards, conservatism, FSE or Vendor design responsibility, etc.)
- VENDOR PRE-QUALIFICATION ASSISTANCE (audits, shop visits, and FSE vendor knowledge).
- PIPE BURIAL CONDITIONS DEVELOPMENT:
 - Review soil properties (modulus, etc.), settlement, bedding and backfill, road crossings
- PIPE DESIGN CONDITIONS DEVELOPMENT (collaboration with Project Team)

2. SPECIFICATIONS DEVELOPMENT

- (DESIGN/ FABRICATION/ QA-QC/ INSTALLATION & BURIAL):
 - FSE originated Specifications -OR- FSE enhancements to Client Specifications and/or PMC Master Piping Specifications;
 - Establish design requirements, design methodologies, and required level of analysis;
 - Minimum pipe performance requirements (e.g. min. pipe stiffness – hoop and axial);
 - Establish proper governing FRP load cases for use in stress analysis;
 - Establish requirements for fabricator testing data or analytical method to document their proposed physical properties for hand lay-up laminates (e.g. shop and field joints, flanges, reducers, smooth turn elbows);
 - Establish fabrication and installation controls, per current industry standard practice;
 - Specify Client preferences (materials, liner, joint type, etc.);
 - PSA's (Project Specific Addendums), or Enhancements to Project Line Class Specifications (as needed, for FRP issues);
 - Establish vendor bid and design report submittal requirements.

3. DETAILED ENGINEERING SUPPORT

- TECHNICAL BID ASSISTANCE
 - Technical RFQ preparation assistance;
 - Technical bid review (bid tabulation for vendor technical comparability), vendor compliance with RFQ and specs;
- Pipe pre-qualification product review (identifies/ qualifies vendor's proposed product design approach, identifies design exceptions/ variations);
 - Provide FRP technical bid conformance recommendations to Project Team.
- DESIGN SUBMITTAL REVIEW (technical compliance review of Vendor's Design Report):
 - Design method and analysis compliance check;
 - Verify structural pipe wall and overlay calculations;
 - Verify vendor's stated allowable stresses (hoop and axial);
 - Identify any overly optimistic material properties;
- REVIEW AWARDED PIPE VENDOR'S STANDARD PROCEDURES (fabrication, QA-QC, ITP – Inspection and Test Plan, review vendor's Bonding Procedures Specification (BPS) including bonder qualification procedures, review shipping/handling procedures, etc.).
- PIPE SYSTEM STRESS AND FLEXIBILITY ANALYSIS (FSE origination mode, or review mode).

4. QUALITY ASSURANCE SURVEILLANCE

- QA FABRICATION INSPECTION (MANUFACTURING SHOP):
 - Alignment meeting with fabricator and EPC:
 - Confirm fabrication implementation of approved design;
 - Align all parties to controlling specifications, ITP and quality requirements;
 - Establish QA inspection program.
 - Full-time 3rd party inspection coverage of fabrication (incl. shop spooling):
 - Qualify/verify shop joiners (laminators) and witness bonder qualification testing;
 - NCR notifications;
 - Detailed QA inspection reports.
- REVIEW INSTALLATION CONTRACTOR'S METHODS STATEMENT AND BONDING PROCEDURES (for compliance with Installation Specification and Fabricator's installation requirements).
- QA INSTALLATION/ JOINING INSPECTION (CONSTRUCTION SITE):
 - Alignment meeting with Contractor and EPC:
 - Confirm installation implementation of approved Methods Statement & Procedures;
 - Align all parties to controlling specifications and quality requirements;
 - Establish QA inspection program.
 - Full-time 3rd party inspection coverage of FRP pipe installation site works:
 - Qualify/verify joiners (laminators) and witness bonder qualification testing;
 - Field handling, joining and burial;
 - Pipe joining (laminated and mechanical)
 - NCR notifications;
 - Liaison between FRP construction and FRP engineering;
 - Detailed QA inspection reports;
 - Witness testing.