Qualifications and Technical Approach

Design and Installation of a Horizontal, Directionally Drilled Water Supply Well

Town of Erie, Colorado

Town of Erie Project # P20-280
Ellingson-DTD Bid # 212001202

Pump testing the Ellingson-DTD installed water supply well in West Texas

April 5, 2021

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ELLINGSON – DTD

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Texas
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Mineral Wells, TX 76067

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1 Introduction

Ellingson-DTD (EDTD) is pleased to submit our qualifications and technical approach for design and installation of a horizontal water supply well for the Town of Erie, Colorado. The well will be adjacent to Boulder Creek, with the purpose of increasing yield by 500-1,000 gallons per minute (gpm) to the town's water supply. This technical proposal outlines our understanding of the scope of work, approach to the project, and qualifications to perform the work. EDTD understands the proposed project is a Construction Manager at Risk (CMAR) agreement between the Town of Erie and the contractor.

2 EDTD Qualifications

EDTD is well-qualified to complete this project. EDTD is a specialty horizontal drilling contractor that has focused specifically on horizontal well installation for water resources development and soil and groundwater remediation since 1994. Our job practices and field operations are geared for well installation and we have developed and patented specialized tooling and methods for horizontal well installation. Within the past five years alone, EDTD has installed over 200 horizontal environmental wells in lengths ranging from 100 feet to over 2,000 feet, for groundwater supply, remediation of chemical contamination, and mine and landfill drainage.

EDTD has successfully installed horizontal wells at sites throughout the United States, including wells in Hawaii, Alaska, and Puerto Rico. We recently completed an industrial water supply well that is 2,300 feet in length at a site in west Texas. In 2016, we installed two well fields for a Colorado municipal water supply increasing the ability to meet the community's summer water demands.

EDTD has worked on numerous energy, pipeline, and chemical/petroleum sites, completed a variety of site training programs (including participation in BROWZ), and installed wells and pipelines under stringent regulation and safety standards.

Our company has the professional skills, knowledge, and experience necessary to assist with the design and installation of the horizontal well along Boulder Creek. The depth of the aquifer, proximity to surface water and the local geology will provide challenges for the horizontal drilling, well installation and development. EDTD has the experience and technical expertise to deal with the site-specific issues as they arise. EDTD is expert in the following areas:

- Research and application-based development of innovative tooling and materials. We pioneered the use of hydraulically coupled horizontal/vertical well systems. For the Erie project, we will work closely with the Town of Erie and Leonard Rice Consulting Water Engineers (LRE) to develop a horizontal well maximizing water yield.
- Selection of appropriate drilling fluids, methods, and equipment compatible with groundwater extraction wells and strategic partnering to extend our equipment capabilities.

- Multiple years of experience in the use of advanced steering tools, such as the Sharewell Tru-Tracker, DrillGuide Gyroscopic Steering Tool (GST) and Digital Control F5 Short Steering Tool (SST) to provide insight on accurate well placement.

EDTD operates with an emphasis on an efficient and safe worksite. We are proud to hold a safety record unmatched in the horizontal directional drilling (HDD) industry. With an Experience Modification Rate (EMR) of less than 0.93, EDTD has not had a single lost time accident or OSHA citation in over 20 years of operation.

EDTD's senior staff includes a number of licensed engineers and scientists who formerly worked as geotechnical and environmental consultants. They are experts in well design and installation for a variety of applications. Our staff will work closely with Erie and LRE to consult on design and constructability issues prior to mobilization, and to mitigate unforeseen situations when in the field. This management approach minimizes downtime and will provide the Town of Erie with a quality final installation.

For this project, we will continue our high-quality service by providing the highest yield and most cost-effective approach for the design and installation of the proposed well. We believe that our successful record with continuous and blind well installations, our innovative methods for locating and installation, our exemplary safety record, and our history of successful well installations validates our ability to assist with the design and installation of horizontal wells for the Town of Erie.

The key personnel who will assist with project design and implementation are shown in the following table. The resumes of these key personnel are also attached.

Name	Responsibilities	Years Experience
Dan Ombalski, PG, PE	Project Director	20+ Water Supply, environmental consulting, screen design, and HDD well installation and operations
Brian Younkin, Ph.D.	Project Engineer – Manager of project operations, project procurement, team management.	15+ Fluid dynamics research and HDD project management
James Ditto	Drilling Supervisor – Supervises drilling operations. Operates drilling and ancillary equipment.	30+ Equipment operator and HDD driller
Jacob Gallagher	Technical Support – HDD operations	16+ years Well installation consulting

3 Relevant Previous Projects Completed by EDTD

Industrial Water Supply Well – Earth, TX

Client Name and Address
Xcel Energy
Amarillo, TX

Client Technical Point of Contact
DJ Parsons
Donovan.J.Parsons@xcelenergy.com

Project Scope
Installation of one water supply well for power generation plant. Total well length is 2,300 feet with 500 feet of screen. Well screen is placed at 195 feet below ground surface (bgs), at the bottom of an approximate 40-foot-thick aquifer. Well is constructed of 12-inch diameter wire-wrap screen with a carbon steel outer shroud. Initially an 8-inch pump was installed to produce 700 gpm. Later, a second (smaller) pump was installed at the other end of the horizontal well to increase production to ~900 gpm.

The team of Dan Ombalski, Brian Younkin and James Ditto worked together on this project. James was the drilling superintendent, Brian providing onsite management and Dan and Brian worked with the client on pre-construction design and field implementation.

Project Date: May-June 2017

Figure 1: 12-inch well screen installed at West Texas site.

Figure 2: EDTD installing an 8-inch pump in the West Texas well.

Public Water Supply Wells – Castle Rock, CO

Client Name and Address
City of Castle Rock, CO

Client Technical Point of Contact
Heather Justus
HJustus@crgov.com

Project Scope
Installation of six public water supply wells (through two contracts) for the Town of Castle Rock, CO. Well lengths ranged from 461 feet to 761 feet in length, with 150 to 420 feet of well screen. The first three wells installed were placed adjacent to Plum Creek at a target depth of 30-32 feet bgs. Horizontal wells are placed next to vertical wells with pumps to increase the zone of influence. Well screen for the first three wells is a combination of slotted and wire-wrap stainless steel. The second phase included three additional wells placed under Plum Creek. Two wells were initially paired with vertical pumping wells. A pump was inserted into the third well. After initial operation, the horizontal well with the pump produced three times the water from the vertical/horizontal pairings. This led to a second pump being installed in one of the horizontal wells. The second phase wells are 6-inch diameter wells with stainless steel slotted

and wire-wrap screen. The Town of Castle Rock consulted with LRE for well placement and general well design.

For this project James Ditto was the drilling superintendent with Brian Younkin providing both field and remote project management. Dan Ombalski worked with the Town of Castle Rock to develop and finalize construction plan.

Project Date: March - June 2016

Figure 3: Well head completion for a Castle Rock, CO horizontal water well.

Environmental Dewatering Well – Waycross, GA

Client Name and Address
Arcadis US
28550 Cabot Drive, Suite 500
Augusta, GA 30901

Client Technical Point of Contact
Jeff Beckner
jeff.beckner@arcadis.com

Project Scope
Installation of one dewatering well for environmental remediation. Total well length is 680 feet with 350 feet of shrouded stainless-steel wire-wrap screen. Well screen is 4-inch diameter with 6-inch diameter riser casing on both sides of the screen to accommodate submersible pumps. Target depth for well screen was 14-24 feet bgs. Well was installed to protect adjacent water body from a groundwater contamination plume.

Project Date: September – 2017

4 Technical Approach

This section describes the approach that EDTD proposes to complete the work items, including our technical approach to the well installation.

4.1 Mobilization and Demobilization

EDTD will mobilize the drilling and support equipment to the project site using our own or contracted trucking. All equipment will be in good operating condition prior to delivery to the site. Mobilization includes setup of the storage areas and work areas, abatement measures, and other initial setup activities, including attendance of the site kick-off meeting and up to ½ day of site-specific training.

Demobilization will include the preparation of all equipment for exit from the site and restoration of the site to a condition reasonably similar to original condition.

The equipment setup will occupy a drill pad approximately 100 x 150 feet. The drill rig is about 65 feet long and 10 feet wide. The mud system is slightly smaller. Additional area is required for a rod trailer, tooling trailer, materials laydown, and drill operator's trailer. There appears to be adequate space for each rig setup and to park our equipment and tooling trailer. The specific area for the drill rig, drill rod, and mud system setup may need some grading and placement of a stable base material.

We will attempt to work on the entry and exit sides of the bore with minimal access improvements. The entry side (south side) appeared to have relatively flat and compact ground that can be traveled by the

trucks to access the drilling area. The exit side (north side) will be used for stringing and welding of the well materials. Planned bore exit is along an access road around the Town of Erie's water reclamation pond.

During discussions with the Town of Erie and LRE it was indicated that waste drilling fluid and cuttings would be discharged to the ground. If for some reason the drilling fluids needed to be containerized, EDTD has included a cost to contain the drill fluid and cuttings in roll-off boxes or baker tanks. As discussed, we are providing pricing for off-site disposal of mud-heavy returns expected at the start of well development. Once an initial volume of drilling fluid is removed from the well (approximately one borehole volume) remaining development will be discharged to the surface. All waste generated (drill cuttings, drilling mud, and water) is assumed to be clean and appropriate for disposal on site.

4.2 Utility Locating and Permitting

EDTD will coordinate with Town of Erie and LRE to identify the bore path and potentially intersecting utilities, pipelines, or other structures. EDTD will work with the Town of Erie (where appropriate) to obtain all necessary permits and perform all utility locates prior to EDTD commencement of drilling. Standby for utility locating beyond four hours will be charged at our standby rate.

This project will require the oversight of a Colorado-licensed water well driller. EDTD has a Colorado-licensed well driller on staff.

4.3 Horizontal Water Well Installation

4.3.1 Borehole Advancement

The drilling rig and primary support equipment for this HDD project will consist of two key units: the directional drill and a mud mixing and supply system.

EDTD plans to use an American Augers DD210 drill rig on this project. The DD210 is a Range 2 rig, handling 31.5-foot drill rods with a hydraulic carriage assembly capable of 210,000 pounds of thrust and pullback, and 24,000 ft. lbs. of torque. The rig is track-mounted and self-propelled.

Figure 4: Aerial view of DD210 setup

The DD210 is fully capable of drilling and reaming bores to over 2000 feet in length. We have used it on pipelines and river crossings exceeding 2,800 feet. We recommend this size drill rig over the previously proposed drill rig due to the drilling conditions identified in a site walk. This larger rig, and stiffer drill rods, can maintain steering control better than a smaller drill rig. Additionally, the larger drill rig provides higher mud flow rates to flush larger gravels and small cobbles out of the bore. A DD210 drill rig will drill a nominal 12-inch diameter pilot bore, making line item 2A of the Bid Sheet not applicable (pilot bore will be invoiced as line item 2B).

The drill rig is supplied with drilling fluid from a separate machine that mixes, removes drill cuttings, and conditions the drill mud for reuse. The mud recycler includes multiple mud tanks, mixing jets, scalper screens/shakers, desilting and desanding hydrocyclones, pumps, and associated fluid conveyance lines. The mud system we supply will have a supply capacity of 800 gpm or greater. The system is staged a short distance away from the drill and is connected by high pressure hoses. The mud system is set up to minimize crew contact with the recycled drilling mud and can be cleaned with relative ease after the project has been completed.

4.3.2 Pilot Bore Locating

Our understanding of the project site indicates that the well will be installed at a maximum depth of approximately 18 feet below the ground surface (2 feet above the bedrock elevation). We have completed a preliminary bore plan that follows industry standard entry curves and bend radii, which results in an entry curve approximately 200 feet in length and an exit curve of approximately 200 feet. These lengths are added to the planned 600 feet of horizontal well screen and are constructed with blank riser casing.

We will use a coil-based magnetic system for locating, such as the Sharewell Tru-Tracker system. This system combines a geomagnetic seeking tool to provide an azimuth for steering, with an induced electromagnetic field to provide precision tracking of the drill bit. These two modes are used during the advancement of each drill rod to follow the bore path precisely. The TruTracker and similar magnetic systems are capable of accurately locating the advancing drill head to within 2% of its current depth.

During the site walk it was observed that entry and exit areas, and pipe laydown area are all on relatively flat-lying, open ground. Some leveling and clearing of pads for drilling and welding/assembly of the pipe will be required prior to mobilization (see discussion above). Depending on the density of brush along the alignment, it may be necessary to lightly grade or clear brush from swaths for the temporary installation of the copper wire coil that is used in tracking (and likely for assembly of the well materials). The surface coil is energized by DC current generated by a portable welding machine, while the drill rig is operating.

4.3.3 Casing and Screen

Tables 3 and 4 within the well specifications document provide specifications for the well materials (screen and riser) to be installed. EDTD has analyzed the requirements for the completed well, as well as the materials properties necessary for a successful installation of the well casing. Our conclusion is that the project requirements are best served with a custom-built, hybrid screen design, constructed of a combination of a wrapped V-wire well screen combined with a perforated exterior encasement.

Installation of well materials in a directional boring faces different challenges than performing that task in a vertical well. Although the pipe is well-supported by the surrounding bore during pullback, the weight of the pipe, combined with the entry and exit curves, imparts significant drag on the well material. Pullback forces are calculated on the basis of pipe weight, diameter, bore diameter, soil skin

friction coefficients, mud density, well length, and other factors. These must be combined with a safety factor, resulting in a minimum tensile strength for the well materials.

A further factor in the installation of well screens is the movement of the pipe through the bore during pullback. As pipe moves through the curved portions of the bore path at the entry and exit, the pipe inside the curve is subjected to compressional stress, while the outside portion attempts to stretch or expand. If the bore radius is less than the bend radius of the pipe, the well materials can fail in the curves, or become wedged to the point of pipe failure due to tensile stresses. This can occur with nearly any pipe.

For wire wrapped well screens, which provide the highest open area and best well performance, an additional failure mode is for the wire wrap to fail under compression/extension in the curves. V-wrapped screens for vertical wells are formed by a V-wire wrapped and spot-welded around a framework consisting of several stainless-steel rods arranged to form the circumference of the desired pipe diameter. In a horizontal well, these rod-based screen designs typically fail in the curves, as the wire wrap detaches from the framework. The supporting framework of rods then buckles, leading to complete failure of the screen.

For horizontal wells, a more robust screen design is to attach a rod-based V-wrap screen over the outside of a heavily perforated stainless pipe. The perforated pipe carries the tensile stress of the pullback; however, the screen is still exposed to potential damage during installation. This integrated, welded unit will survive the stresses of installation in shorter wells; however, the screen can still become damaged. For this reason, we do not recommend this standard screen configuration in wells of the length required for the Boulder Creek project.

An alternative method, which we have used for water supply wells in Colorado, is a double-V-wrap configuration. An inner, pipe-based V-wrapped screen is encased in an outer, rod-based wire wrap screen. If any damage occurs to either screen, the other is there to provide a secondary screen. This configuration has been proven in several installations, but still does not provide the tensile strength and confidence for pullback for larger diameter and longer bores such as the Boulder Creek horizontal well.

For the Erie well, we have partnered with screen suppliers to develop a hybrid well screen. This integrated screen system combines a conventional rod-based, V-wrapped inner screen component, which is capable of passing high volumes of water while resisting plugging or obstruction by fine-grained soil, with an outer, protective shield of perforated tubing. The outer shield is designed to withstand the stresses of installation, while causing minimal restriction of water flow through the large round-hole perforations.

The V-wrapped portion is sufficiently long to match the perforated portion of the outer tubing, which has short blank sections at each end to facilitate welding and assembly. The outer tubing will be perforated with ½-inch diameter holes. The V-wrap is fastened inside the outer perforated pipe and has integrated barriers at each end to prevent fines from migrating past the screen. This inner screen will be

manufactured with a nominal 8-inch inner diameter to meet the project specifications. The outer perforated pipe will be 10-inch carbon steel.

Riser pipe on both ends of the screen will be 10 inches nominal diameter, to provide a flush exterior coupling with the well screen. The riser is specified as ASTM A53 carbon steel.

The well materials will be delivered in both 20- and 40-foot sections and will be welded on site. Appropriate controls will be observed (clearing, fire watch, etc.) during the welding process to prevent fires sparked by welding operations. During assembly and pullback, the risers and screen will be supported, as necessary, on rollers and with slings and aerial lifts to reduce pullback stresses and minimize the chance of screen or pipe damage. The well materials will be pulled back from the exit end, following best practices such as reducing the exit bore angle.

4.3.4 Surface Seals and Wellhead Completion

To provide a surface seal and prevent subsidence of the open bore leading from the HDD entry pit to the target depth, we propose to backfill the upper part of the riser bore with a neat cement-bentonite grout. This prevents migration of surface waters down the open bore and is also accomplished to fulfill state regulations for water well completion.

To accomplish this EDTD will install a tremie to approximately 40 feet down the annulus. A small volume, thick plug of cement bentonite grout will then be pumped to create a plug of a few feet in length to create an initial seal against subsequent downhole grout migration. After that plug has set, the tremie pipe will be reset to the top of the plug and the well will be grouted for a distance of 20 feet, withdrawing the tremie as the operation progresses. If bore collapsing conditions occur and grout cannot be placed via tremie pipe EDTD may elect to excavate around the well heads and pour grout around the near-surface riser sections. Grout seals will be at least 20 feet in length to meet state regulations and placed below the anticipated pitless lateral location (4 feet bgs).

Scope of work for the well drilling and installation contract does not include any additional surface works. Pitless adaptors, conveyance piping, surface casing, etc. will be installed by others at a later date.

4.3.5 Well Development

After we have installed the well, we will immediately complete the development process.

EDTD will employ jetting, surging, air lift techniques, and/or pumping, singly or in combination, to clear fine-grained material from the well screen and screen slots, and to agitate and mobilize fines from the bore annulus and move them into the well for removal. Long well screens generally require several methods of development to focus attention on the various components of the system (screen and annulus in particular). Depending on the characteristics of the formation and bore, we have found that each of the methods noted can provide excellent results in well development. The bid sheet provided by the Town of Erie specifies development durations. Actual time may vary depending on development efficiency and water turbidity criteria.

As requested EDTD will capture the first borehole volume of during flushing. This first borehole volume is generally the consistency of drilling fluid. We have identified a hauler and disposal location for drilling fluids in the Weld County, CO area. The Town will handle transportation and disposal of this development volume. We have assumed that development water after the initial flush may be discharged to the ground at or near the drill site, and that additional conveyance or transportation of development water will not be necessary.

Air lift has proven to be very effective in well development. EDTD has used this method on several horizontal well systems, including the six water supply wells for the Town of Castle Rock, CO. Air lifting will require an appropriate amount of submergence of the educator pipe. If it is possible, this will be the preferred method for the initial removal of water and drilling mud from the borehole.

4.3.6 Well Testing

The SOW specifies that a temporary test pump will be installed in the well after completion and development. EDTD will install temporary pump(s) and perform requested pump tests. We propose testing the effectiveness of pumping from one end of the well AND with pumps in both ends of the wells. Depending on test pump configurations transducers will be placed in the horizontal well and in nearby monitoring wells during pump tests. At the conclusion of the pump test EDTD will provide a report of the results.

4.3.7 Additional Tasks

Additional tasks to be completed by EDTD include:

- Submission of a well As-Built report to the Town or Erie
- Well video survey at the completion of well development
- Well disinfection at the completion of the project

Figure 5: Protective skid for submersible pump in horizontal well

4.4 Management of Drilling Derived Waste (DDW)

EDTD assumes that drill cuttings and development water may all be disposed on-site. As discussed above the first borehole volume of development water will be the consistency of drilling fluid and will be hauled off-site to an approved landfill. The Town of Erie will be responsible for the transportation and disposal of the first flush development waste.

5 Work Schedule

We estimate that it will take approximately 5-7 weeks to complete the well installation, including mobilization, drilling, completion, development, and testing. The drilling and well installation will take 2-3 weeks, two weeks for development, one week for pump testing, and final tasks comprising the remainder of the time. EDTD would demobilize our major equipment once the well materials are installed, completing the final tasks with smaller equipment. EDTD assumes 10-hour workdays, Monday through Saturday.

A preliminary schedule is provided on the next page. Note that well material lead times are 6-8 weeks. Therefore a contract awarded at the end of April will have a start of field activities in the middle/end of June. To ensure the well is assembled to full length before installation well materials should be onsite within several days of the start of field activities. Also note that holidays are not shown on schedule. Ellingson DTD would schedule for crews to be home for two days for holidays and include a travel day on each side of the two days at home.

6 Health and Safety

EDTD has corporate policies regarding the conducting of daily safety meetings that include our crew and all LRE or Owner site representatives. Our crews develop pre-task safety plans as necessary, and continually monitoring the site activities to promote awareness of the work environment and associated safety issues and adherence to various safety elements, including the following:

- Onsite Health, Safety, and Environment Orientation
- Safe Behavior Observation Program
- Follow established HSP(s)/AHA(s)
- Employment of an Occupational Health Care Provider
- Retaining Employee Training Records and Documentation at the Work Site
- Employee Drug Testing Program
- Daily Safety Meetings
- Accident Investigation Program
- Worksite Inspections with Project Team Members

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Town of Erie - Horizontal Water Well Installation

Preliminary Work Schedule

	Week 1							Week 2							Week 3							Week 4							Week 5							Week 6						
Activity	M	T	W	Th	F	Sat	Sun	M	T	W	Th	F	Sat	Sun	M	T	W	Th	F	Sat	Sun	M	T	W	Th	F	Sat	Sun	M	T	W	Th	F	Sat	Sun	M	T	W	Th	F	Sat	Sun
Mobilization and set-up																																									
Drilling of pilot bore																																									
Well material assembly and staging																																									
Reaming to 16" diameter bore																																									
Swab pass																																									
Well installation																																									
Drilling equipment demobilization																																									
Development (flushing)																																									
Development (jetting)																																									
Development (pump/surge)																																									
Grout seal																																									
Well video																																									
Pump test																																									
Well disinfection																																									
Site clean-up and final demobilization																																									

***Lead time for well material order is 6-8 weeks**

7 Bid Qualifications

EDTD maintains high quality standards to assure that our directional drilling projects meet the specifications described in the Statement of Work. EDTD personnel inspect all well materials for suitability upon their delivery to the site, perform necessary calibrations for locating equipment, and perform testing, as needed, for quality control purposes.

Directed Technologies Drilling (DTD) was incorporated in 1995 as a horizontal drilling company that specializes in environmental well installation. In 2019 DTD was acquired by Ellingson Companies to form Ellingson-DTD. Ellingson-DTD maintains the same core staff of expertise from DTD with the added benefit of a larger labor force and greater equipment inventory.

7.1.1 Bid Sheet Discussion

Attached to the end of this proposal document is Ellingson-DTD's bid sheet providing an itemized pricing to complete this work. The bid sheet is based on discussions from March 31st. Regarding the request for open-book accounting and an understanding of associated "construction management fees" we have provided the following additional information.

It is our understanding, based on Articles 11 and 13 of the contract, that there are two "types" of billable rate: so-called "unit price work" and "cost based" terms (i.e. cost +fee/T&M/etc).

The contract is clear on what is an acceptable markup or management fee for "cost based" terms, however "unit price work" appears to be treated differently, with good reason.

Since we are self-performing the drilling and the vast majority of this project will be billed on footage and "per each" unit rates, our actual level of profit is contingent on the efficiency and execution of the work and cannot be quantified until after the project is completed. As such, it is impractical to try to distill down the various assumptions, risk premia, and input costs into a single percentage or dollar "fee".

Instead, we have taken the sum of the "base scope" from line items 1-7 and normalized the pricing to a unit cost of $/diameter inch/ft and $/anticipated GPM. In the table below, you'll find comparisons of this project's unit rates to two similar contracts we've had installing water supply wells for the Town of Castle Rock and Xcel Energy respectively. The rate of the drilling and installation for the Town of Erie project is similar to both of these other projects, regardless of the method of comparison.

We believe this aggregated, normalized unit cost comparison can provide the context necessary for the town to feel confident that the contract pricing for this "unit price work" is reasonable and fair.

For the "cost based" line items, we've provided our costs with a 15% markup, which are, to the best of our understanding, in accordance with Article 11.4.C.2.

Table 1: Price Comparisons to similar water supply well projects

Project	Cost for drilling and well installation normalized to a cost per diameter inch	Project Cost per Anticipated Gallons
Castle Rock, CO (2016)	$ 32.28	$ 2,124.59
Xcel Energy (2017)	$ 29.37	$ 1,561.64
Town of Erie, CO (2021)	$ 37.50	$ 830.73

Per discussions via email Ellingson-DTD will note that boring logs and site visits to the Erie well site indicate more, and larger cobbles than the Castle Rock drill site. We have addressed these more challenging drilling conditions by specifying a larger drill rig. This larger drilling set-up reflects in the increase in cost per diameter-inch comparisons.

7.1.2 Project Controls

The site superintendent in the field is responsible for initiating and maintaining all project controls to assure project safety, quality, and schedule. These will be maintained through the duration of the project, and include:

- Morning "tail gate" meetings with the crew and Erie/LRE field representatives to discuss the tasks to be completed that day, the particular safety items to focus on, and any special items that need attention.
- Daily field reports are completed each evening to document the day's activities. These reports are sent to our client as well as EDTD management.
- The project manager, site superintendent, and drilling supervisor are in constant communication to maintain a dialog about project progress. The project manager is responsible for maintaining a check on the actual placement of the pilot bore and drain materials, while the drilling supervisor focuses on the drilling aspects. This division of labor helps assure that the well is installed as specified.

7.1.3 Risk Management

EDTD uses a reliable, proven navigation system to provide tracking and steering corrections during pilot bore advancement for horizontal drilling and installation projects. We require that the client/owner provide current information on utilities and other buried critical structures, prior to beginning any bore. If no reliable information is available for buried critical structures, we recommend that the client use Ground Penetrating Radar, or other geophysical means, to identify these structures. EDTD does not take responsibility for identifying buried infrastructure. Erie may have additional requirements for the potholing and visual examination of crossing pipelines, etc. EDTD will work closely with Erie personnel to definitively locate all buried structures crossing the bore path. If extended time is required to complete this task, which delays drilling activities, EDTD will charge our crew time at the standby rate.

In setting up the bore path, we rely on this client-supplied information to review the client-proposed bore paths. We will provide our input on safe and reasonable offsets from known obstacles. This not

only helps prevent collisions, but also reduces the chances of drill fluid migrating preferentially along backfill for utilities trenches, etc., which can result in frac-outs many feet away from the bore path.

During drilling, our operators are continuously monitoring the drillhead advancement. If an obstruction is encountered, we immediately notify the client field representative and pause in drilling until the obstruction is identified and we are clear to proceed. If a buried obstruction is encountered and the situation cannot be resolved within two hours, the crew will move into a standby mode until the situation is solved.

7.2 Material and Equipment Storage

EDTD maintains secure storage for all equipment, including all hand tools and supplies. All chemicals and supplies are stored in accordance with governmental requirements and manufacturer's recommendations. SDS sheets are available on site for any chemicals stored.

EDTD will coordinate with Erie's field representatives to occupy the designated storage area, and will prepare the decontamination area with berms, plastic sheeting, or other controls to contain potentially contaminated water and/or rinsate.

7.3 Submittals / Deliverables

EDTD will submit all deliverables as requested. These may include the following:

- Licenses, certifications, and permitting requirements
- Site Specific Health & Safety Plan
- Confirmation of personnel qualifications and other required training certifications
- Site personnel information for background checks and site entry pass issuance
- Task/Activity Hazard Analysis, if required
- Work plan, including:
    - Proposed site/equipment layout
    - Requirements for site access
    - Requirements for water during drilling operations
    - Waste container requirements and waste fluid management
    - Material specifications and MSDS
- Quality Control Plan
- Construction Schedule

During the project, we will remain current with daily and weekly reports, and supplementary submittals. Post construction submittals will be delivered complete and on-time.

8 Assumptions for Proposal Preparation

- Drilling conditions are assumed to be in sands, gravels, and small cobbles.

- We assume the ground formation to be drilled can be drilled with a standard jetting bit assembly, and that the geologic formation will support a borehole for enough time to allow the installation of a well.
- The navigating and locating systems to be used are capable of drilling to approximately 2% of depth. We will use best practices for locating and attempt to the best of our ability to maintain the specified grades and pitches, however local heterogeneities in drilling conditions may result in deviations from the specifications.
- Locating will be completed with wireline, coil-based navigation system.
- EDTD will have access to all available surface areas above the boreholes for purposes of: 1) tracking the drill string, and 2) identifying utilities.
- Working hours are 0700 to 1900 Monday through Saturday.
- All foundations, footings, and/or buried utilities will be marked by Town of Erie for X-Y location and depth prior to our arrival on site.
- EDTD will initiate a phone call to the local "One-Call" utility locating service prior to drilling activities. However, we expect utility locating (i.e., potholing) will be provided by the Town of Erie.
- An adequate water supply is available onsite and that EDTD will provide a water truck for onsite use only.
- Town of Erie and/or LRE will provide an on-site liaison to help with logistics and issues that may be encountered while drilling.
- Town of Erie will handle necessary easement permit applications. If our assistance is required for this, we request prior notification in sufficient time to acquire permits prior to mobilization to the site. EDTD will obtain a surface water – well development discharge permit.
- EDTD will provide Colorado--licensed well driller oversight.
- We have assumed that the work can be accomplished in Level D PPE (hard hat, eye and ear protection, reinforced-toe boots, standard work clothing).
- During drilling and reaming, drilling fluid may migrate to nearby utilities or other subsurface installations. EDTD will attempt to limit this possibility and will control and contain any drilling fluids that appear at the surface during the drilling operation.
- EDTD will manage the waste on site, pumping it to containers or surface disposal areas marked by Erie. EDTD will not be responsible for the storage or disposal of these wastes.

9 Resumes

Daniel W. Ombalski, PG, PE
General Manager

Education

B.S., Geological Engineering, The University of Missouri - Rolla, 1996
B.S., Geosciences, The Pennsylvania State University, 1994

Certifications

- Indiana Licensed Water Well Driller
- Registered Pennsylvania Professional Geologist, PG-003856-E
- Registered Alabama Professional Geologist, PG-1070
- Registered Pennsylvania Professional Engineer PE-085124
- OSHA 1910.120 40-HR Hazardous Waste Operations Certified and up-to-date 8-hr refreshers

Qualifications and Experience

May 2019 – Present / *General Manager*, Ellingson-DTD, Bellefonte, Pennsylvania
Manage, direct, and oversee HDD division specializing in the installation of horizontal wells across the United States. Specifically involved in proposing, designing, and overseeing the installation of horizontal wells for groundwater resources, environmental remediation, and resource recovery.

May 2009 – May 2019 / *President*, Directed Technologies Drilling, Inc., Bellefonte, Pennsylvania
Manage, direct, and oversee business development and growth of a niche firm specializing in the installation of horizontal wells across the United States. Specifically involved in proposing, designing, and overseeing the installation of horizontal wells for groundwater resources, environmental remediation, and resource recovery.

April 2004 – April 2009 / *Vice President*, Directed Technologies Drilling, Inc., Julian, Pennsylvania
Manage the eastern office of DTD, Inc. Direct and oversee the high quality of installed horizontal wells for environmental remediation and water resource management. Project development, coordination, planning, well screen design and reporting, as well as client and project management.

July 1998 – March 2004 / *Geologist*, Groundwater Services, US Filter Operating Services (formerly Nittany Geoscience)
Manage clean and contaminated groundwater investigations, with clients including public water suppliers, small and large industrials, non-profits, and academia. Services include site remediation conducted under Pennsylvania Act 2 regulations; quarterly reporting and data analysis for a RCRA regulated sites; design and conduct Phase II investigations and reporting. Complete aquifer testing and data analysis, well siting using fracture trace analysis. Provide well construction supervision, soil and bedrock logging and groundwater sampling. Specific project experience includes: stability investigations in karst terrane, grouting for soil stabilization in karst terrane, protection of groundwater supplies from

agricultural practices (CAFOs) in Karst, Geoprobe (direct-push soil sampling and permanent monitoring well installation) operation, downhole video logging, borehole caliper logging.

May 1997 – June 1998 / *Geoscientist*, Nittany Geoscience, Inc., State College, Pennsylvania
Well siting with fracture trace analysis, well construction supervision soil and groundwater sample collection, use of dataloggers for digital storage of time series field measurements of aquifer and borehole tests, Geoprobe operation, downhole video logging, groundwater monitoring, and equipment maintenance.

November 1996 – January 1997 / Surveyor / CAD Operator, Control Point Associates, Lansdale, Pennsylvania
Generated site plans and topographical maps. Created topographical site cross-section maps. Completed outbound survey of commercial properties for future development. Commercial building, curb, and road stake out. Location and topographical survey.

June 1995 / *Hydrogeologist*, USGS - Penn State Geoscience, Long Key, FL
Drilled and constructed monitoring wells for the characterization of sewage injection wells on Long Key. Completed elevations survey of wells. Drilling completed using a NX wireline system.

August 1994 – December 1994 / *Field Engineer*, Sverdrup Environmental, Maryland Heights, MO
Conducted a contaminant infiltration study of an Air Force base wastewater disposal system. Field task leader for a lead-based paint and dust sampling program. Analyzed lab data and created graphs and tables for data presentation. Field sampled soil, and groundwater. Field described soil samples. Monitored excavation and removal of a battery disposal site. Conducted air monitoring.

June 1994 – July 1994 / *Field Assistant*, Penn State Geoscience Department, Cumberland House, Saskatchewan, Canada
Conducted a GPS survey on a forty-mile portion of the Saskatchewan River. Land surveyed transects at preset stations. Collected water velocity measurements. Sampled levee and bedload sediments

June 1984 – August 1993 / *Field Engineer-Survey Crew Chief*, Ombalski Consulting Engineers, Lebanon, NJ
Preparation of Environmental Impact Statement (EIS/EAR) reports for major and minor residential subdivisions. Run site runoff and drainage calculations. Field tested percolation of soils, using single hole and pitbail techniques. Collect and log soils in field. Run K-class, grain size, and hydrometer soil tests for USDA Soil Classification. Computer generation of topographical contour site map. Created topographical site cross-section maps. Created final site plan maps. Outbound survey of commercial property development. Commercial, residential, and public building, curb, sewer and road stake out and location surveys. Topographical survey.

June 1992 – August 1992 / *Soils Laboratory Technician*, Melick & Tulley and Associates, Bound Brook, NJ
Completed K-class, grain size, and hydrometer soil tests for USDA Soil Classification. Conducted proctor, modified proctor, soil compaction, soil cement breaks, permeability tests, and atterburg limits.

Publications and Presentations

- Battelle, 2008 Remediation of Recalcitrant Compounds, Monterey, California – In-Situ Chemical Redox using a 1,140' long horizontal well at Edwards AFB.
- Ombalski, D., and D. Brandes. 2006. *Pennsylvania Comprehensive Wildlife Conservation Strategy (CWCS)* Species Assessment – Golden Eagle, *Aquila chrysaetos*.
- NGWA 2005 Annual Meeting, December 2005, Atlanta, Georgia – Physical Requirements of Successful Development of Horizontal Wells, with George Losonsky.
- NGWA 2004 Annual Meeting, December 2004, Las Vegas, Nevada – Horizontal Air Sparging –A Program for Estimating the Air Discharge Through a Horizontal Well Screen
- Brandes, D. & Ombalski, D.W. 2004. Modeling raptor migration pathways using a fluid-flow analogy. Journal of Raptor Research 38:195-207.
- Canadian/American International Groundwater Conference, July 2001, Banff, Alberta, Canada. Presented "Development of a High Volume Groundwater Production Well in the Elkton Aquifer".
- Ombalski, Daniel W., "Flow Energy as Determined from D_{90} and D_{50} in Heterogeneous Cave Sediments," thesis, The Pennsylvania State University.

Other

Feb 2001-Present / Tussey Mountain Hawkwatch Coordinator, Pine Grove Mills, Pennsylvania

Coordinate all activities relating to the monitoring of golden eagle migration, including: database management, hiring of volunteers, fund raising, and public outreach.

Brian D Younkin, Ph.D.
Project Engineer

Education

Ph.D., Civil and Environmental Engineering, Pennsylvania State University, 2008
B.S., Civil Engineering, Pennsylvania State University, 1999

Certifications

- 40 Hr. HAZWOPER training w/ 8 Hr. Refresher
- 8 Hr. HAZWOPER Supervisor training
- 10 Hr. OSHA Construction training
- Transportation Worker Identification Card for secure maritime facilities access
- ARSC – Basic Plus safety training (Refinery access and contracting)
- First Aid & CPR

Qualifications and Experience

2013 – Present / *Project Engineer*, Ellingson-DTD (formerly Directed Technologies Drilling), Bellefonte, PA
Provides engineering technical support for horizontal directional drilling (HDD) projects. Developed a computer program for horizontal injection well screen design. Field project manager for environmental and water resources projects.

2009 – 2013 / *Visiting Assistant Professor*, Civil and Environmental Engineering Dept., Bucknell University, Lewisburg, PA
Courses Taught

ENST 221	Hazardous Waste and Society
ENGR 220	Engineering Mechanics: Statics
ENGR 222	Fluid Mechanics
CENG 320	Water Resources Engineering

2011 – 2013 / *Consulting Engineer*, Directed Technologies Drilling Inc., Bellefonte, PA

- Develop computer program to calculate well screen specifications
- Conduct experiments to quantify air sparge systems

2008 – 2010 / *Instructor*, Civil and Environmental Engineering Dept., Penn State University, University Park, PA
Courses Taught

CE 360	Fluid Mechanics
CE 362	Hydraulic Engineering
CE 363	Fluid Mechanics Laboratory

CE 370 Introduction to Environmental Engineering

2004 – 2007 / *Teaching Assistant*, Civil and Environmental Engineering Dept., Penn State University, University Park, PA

- Provided instruction for multiple courses
- Prepared instructional materials including lectures, assignments and quizzes
- Held tutoring sessions and office hours for students

2003 - 2009 / *Research Assistant*, Civil and Environmental Engineering, Penn State University, University Park, PA

- Researched river bed scour with the Alaska Fish and Wildlife Dept.
- Developed relationships between water turbidity and boat-generated waves
- Conducted laboratory flume experiments on river bed scouring

2000 – 2002 / *Research Assistant*, Civil and Environmental Engineering, Colorado State University, Fort Collins, CO

- Researched urban stormwater modelling
- Assisted with debugging and updating EPA's Stormwater Management Model (SWMM)
- Provided technical support for MIKE SWMM (commercial version of EPA SWMM), including intern position with Danish Hydraulic Institute in Philadelphia, PA (Summer 2001)

Selected Publications

- Younkin, B.D., Hill, D.F., 2009, "*Rapid Profiling of an Evolving Bedform Using Planar Laser Sheet Illumination*" Journal of Hydraulic Engineering, v.135(10), pp. 852-856.
- Hill, D.F., Younkin, B.D., 2009, "*A Simple Estimation of the Growth Rate and Equilibrium Size of Bedforms Created by a Turbulent Wall Jet*" Journal of Hydraulic Research, v.47(5), pp.619-625.
- Hill, D.F., Younkin, B.D., 2006, "*Measurements of Turbulent Flow In and Around Scour Holes*," Experiments in Fluids, v.41, pp. 295-307.

Selected Lectures and Presentations

- "Horizontal Drilling 101" presentations to USEPA, Society of American Military Engineers (SAME), USEPA State Coalition of Dry Clear Remediation, CDM Smith, and others.
- Instructor for Battelle Memorial Institute short course on horizontal directional drilling: 2016, 2014
- Poster Session – Battelle Conference, 2018 - Application of Screen Design for Horizontal Injection Well
- Poster Session – Battelle Conference, 2016 - Screen Design for Horizontal Injection Wells
- Poster Session – AEHS, Amherst, MA, 2014 - Accessing the Inaccessible, Horizontal Directional Drilling to Obtain Soil Samples
- Poster Session – Battelle Conference, 2014 - Quantifying Air Discharge Rates through Horizontal Well Screen Slots

James Ditto
Senior Drilling Supervisor

Certifications

- 40 Hr. HAZWOPR training
- Coast Guard - Transportation Worker Identification Card for secure maritime facilities access
- ARSC – Basic Plus safety training (Refinery access and contracting)
- Radiation Worker II (radiological site work)

Qualifications and Experience

2008 – Present / *Drilling Supervisor,* Ellingson-DTD (formerly Directed Technologies Drilling, Inc.), Mineral Wells, TX

Supervised drilling operations with American Augers 210 and CMS 6015. Planned operations and managed drilling operations for large scale drilling programs. Manages shop and maintenance facility in Mineral Wells, TX.

2002 – 2008 / *Assistant Operations Manager,* Mears HDD LLC, Richardson, TX

Supervised Mears crews and subcontractors on large bore job in Richardson, Texas. In January 2004 began work as assistant operations manager for horizontal directional drilling operations.

1992 – 2002 */ Operations Manager,* C & B Associates

Managed horizontal directional drilling operations, which included the activities of 14 company rigs and all subcontractors on HDD projects.

1990 -- 1992 */ Pipe Fitter,* Brown and Root

Employed as pipe fitter on 32-inch main steam lines for the Glenn Rose Nuclear Plant, through plant completion.

1988-1990 */ Co-owner and manager,* Bedell & Ditto Construction

Builders of conventional drill rigs and tooling for drilling solid rock. Established successful business, which sold after two years..

1979 – 1988 / *Co-owner and Manager,* Oil Field Stimulation Company

Specializing in oil field acidizing and stimulation. Employed a total of 36 employees, with 9 supervisors. Performed annual sales of $6M.

1970 – 1979 / *Field hand to Sales Engineering,* The Western Company

Started at entry level and worked up to management level in Sales and Operations management.

Jacob Gallagher
Business Development Manager

Education

B.S., Chemical Biology, University of California Berkeley, 2004

Certifications

- 40 Hr. HAZWOPER training w/ 8 Hr. Refresher
- 8 Hr. HAZWOPER Supervisor training
- 10 Hr. OSHA Construction training
- ARSC – Basic Plus safety training (Refinery access and contracting)
- First Aid & CPR
- In process: CO well driller's license (applying)

Qualifications and Experience

2017 – Present / *Business Development and Marketing Manager,* Ellingson-DTD (formerly Directed Technologies Drilling, Inc.), Denver CO

Business development for Western US (front range to west coast). Educating clients on feasibility, limitations, capabilities etc. of HDD for well applications. Provide project-specific support and guidance on potential and planned projects. Offer guidance and recommendations for well configurations, layout, material selection, design considerations, development practices and so forth.

2016 – 2017 / *Business Development Manager,* Cascade Drilling, Denver CO

Business development for Intermountain West and Southwest Regions. Responsible for maintaining backlog of 4 distinct business units (6 field offices). Identifying project opportunities and working with operations to develop competitive and realistic proposals. Educating clients on feasibility, limitations, capabilities, etc. of various vertical drilling technologies within the company's fleet.

2007 – 2016 */ Business Development Manager, WDC Exploration & Wells/National Exploration Wells & Pumps, Richmond/Sacramento CA*

Business development for Northern CA Region. Responsible for maintaining backlog of 2 distinct business units. Identifying project opportunities and working with operations to develop competitive and realistic proposals. Educating clients on feasibility, limitations, capabilities, etc. of various vertical drilling technologies within the company's fleet.

2004 -- 2007 */ Field Technician, Operator, Project Manager, Precision Sampling Inc, Richmond CA*

Worked up from helper to driller and project manager. Direct push, hollow stem auger, sonic, direct sensing technologies, ISCO/ISCR injection applications and Cone Penetrometer Testing.

Professional Associations

- Colorado Ground Water Association
- National Ground Water Association
- American Groundwater Trust
- Colorado Environmental Management Society
- American Water Resources Association
- Professional Environmental Management Association
- Association of Environmental/Engineering Geologists
- American Institute of Professional Geologists
- Society of American Military Engineers
- Northwest Environmental Business Council
- Groundwater Resources Association of California

Selected Publications

- Gallagher, J., Bardsley, D., 2012, "*Why Standard Penetration Should Stay Standardized (And a Lesson in Acronyms)*" National Driller, v.33(5)
- Galalgher, J., 2018, "Mine Tailings Drainage: *"A Bottoms Up Approach Using HDD Well Installation Methods"*, Colorado State University; 2018 International Tailings and Mine Waste Symposium Proceedings

Nondisclosure

The information (data) provided in this response to data request, proposal or quotation constitutes trade secrets and/or information that is commercial or financial and confidential or privileged. It is furnished in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes, unless permitted by law, provided, however, that in the event a contract is awarded on the basis of this proposal or quotation the Customer shall have the right to use and disclose this information (data) to the extent provided by law. The restriction does not limit the Customer's right to use or disclose this information (data) if obtained from another source without restriction.

Bid Schedules A

Item No.	Description	Units	No. of Units [A]	Unit Price	Total Price
1.	Performance and Payment Bonding	Lump Sum	1	$ 8,437	$ 8,437
2.	Mobilization/Demobilization	Lump Sum	1	$ 57,000	$ 57,000
3.	Borehole Drilling				
	A. Drill Pilot Borehole	Linear Foot	1000	$ 165	$ 165,000
	B. Ream to 16-inch OD Borehole	Linear Foot	1000	$ 96	$ 96,000
	C. Swab Pass	Linear Foot	1000	$ 27	$ 27,000
	D. Well Path Accuracy Survey to Conform to 3D Alignment, test, Caliper Log	Lump Sum	1	$ 3,000	$ 3,000
	SUBTOTAL OF ITEMS NO. 1 –3				**$ 356,437**
4.	Casing and Screen Material				
	A. Blank Well Casing 10-inch ID - ASTM A53, A606 Type 4 steel, Type F, E, or S, Grade B	Linear Foot	450	$ 81.76	$ 36,792
	B. Screen - 10-inch shrouded wire-wrap screen. Outer shroud 0.5-inch perforated 10-inch ASTM A53, A606 Type 4 steel, Type F, E or S, Grade B. Inner 8-inch, 0.020-inch wire-wrapped well screen Type 304 stainless steel (ASTM A312, Schedule 12S.	Linear Foot	600	$ 275.69	$ 165,414
5.	Casing and Screen Installation				
	A. Well Casing and Screen	Linear Foot	1000	$ 27	$ 27,00
6.	Furnish and Install Surface Cement Grout [B]				
	A. Well Casing Grout Seal from	Per End	2	$ 6,500	$ 13,000
7.	Well Completion and Development				
	A. Pump/Surge Development	Hourly	48	$ 670	$ 32,160
	B. Well Jetting	Hourly	48	$ 670	$ 32,160
	C. Final Well Video	Lump Sum	1	$ 5,000	$ 5,000
	D. Surface Casing Construction (18-inch diameter)	Linear Foot	40	$ 330	$ 13,200
8.	Well Testing				

	A. Furnish, Install and Remove Test Pumping, Monitoring, and Ancillary Equipment	Lump Sum	1	$ 110,000	$ 110,000
	B. Pumping Test	Hourly	120	$ 400	$ 48,000
SUBTOTAL OF ITEMS NO. 4-8:					**$ 482,726**
9.	Rig Hourly Rate				
	A. With Crew	Hourly	8	$ 1,169	$ 9,348
	B. Without Crew	Hourly	8	$ 861	$ 6,891
10.	Contingency Borehole Re-Drill				
	A. Drill Pilot Borehole	Hourly	70	$ 1,697	$ 118,818
	B. Ream to 16-inch OD Borehole	Hourly	40	$ 1,353	$ 54,102
	C. Swab Pass	Hourly	20	$ 1,353	$ 27,051
	D. Well Path Accuracy Survey to Conform to 3D Alignment, test, Caliper Log	Hourly	1	$ 3,000	$ 3,000
11.	Contingency Drilling Fluid Seepage Control				
	A. Containment, management, and transport of inadvertent return	Hourly	20	$ 526	$ 10,514
12.	Potholes	Day	2	$ 4,439	$ 8,878
SUBTOTAL OF ITEMS NO. 9-12:					**$ 238,602**
GRAND TOTAL OF UNIT PRICES (in written words):		One million, seventy-seven thousand, seven hundred and sixty-five dollars			
SIGNED BY:					
DATE:		April 6, 2021			
COMPANY:		Ellingson-DTD			
RIG AVAILABILITY DATE:		30 days from contract award			

Notes:

[A] Quantities are not guaranteed. Final payment will be based on actual quantities. If the required quantities of the items listed above are increased by Change Order, the adjustment will be made using the unit prices set forth above and shall apply to such increased or decreased quantities.

[B] The cement grout, and formation stabilizer material volume estimates are based on 30 percent over the calculated annulus volume. Use 15 feet vertical bgs and projection of lateral as basis of grout volume.

The following drilling equipment will be used in the execution of this contract:

Drill Rig Equipment size/class_200,000 lbs. class drill rig with Range 2 drill rods_

Mud Recycling System size/class_800 gpm cleaning capacity mud recycler

Name of Bidder__**Ellingson-DTD**_____

By____Brian Younkin, Ph.D._____

Address__56113 State Highway 56_____

_____West Concord, MN 55985_____