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**An Industry Survey and Analysis of the Effectiveness of Differing
Prequalification and Qualification Packages**

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1. ABSTRACT

The purpose of this paper is to identify the intent of various types of prequalification or qualification packages for trenchless construction projects and to recognize the advantages and disadvantages of each. To do so, a survey was developed in which a diverse set of engineers, owners, and contractors were asked pointed questions to gain industry feedback from varying viewpoints. Survey respondents were asked to comment on two types of prequalification packages and two types of qualification packages, all aimed at procuring qualified contractors to perform the contracted work. Although the identities of survey respondents and their project examples are not disclosed, participants were encouraged to describe their personal experience with prequalification and qualification packages based on past projects. These examples can provide the reader with the guidance and tools necessary to properly evaluate the type of prequalification or qualification package that is most appropriate for accomplishing their project goals. An analysis of the survey results is also provided, tying the results together and identifying needs or deficiencies for each type of prequalification or qualification package.

2. INTRODUCTION

Trenchless technology is a family of construction techniques for installing or rehabilitating underground infrastructure with minimal disruption to surface traffic, businesses, and residents. Trenchless construction methods can vary from traditional cut and cover techniques in numerous ways, whether it be the necessity of highly specialized equipment, heightened importance of efficiently orchestrating sequence of work and staging, or by the complexity of construction risks present in the project. One must have skilled personnel to be successful as a trenchless contractor. Skilled estimators, superintendents, foreman, operators, and support crew must all know their functions well and work collaboratively to complete a project successfully. Due to the inherent risks involved in trenchless technology, the contractor must also be able to identify potential risks prior to construction and brainstorm ways to mitigate those risks. The contractor must have contingency plans in place and be well equipped to manage unexpected or non-desirable events in a timely and efficient manner should they arise during construction. Furthermore, contractors must have a drive to ever increase their capabilities and professional skills, while maintaining a high degree of ethics to work collaboratively with engineers and owners. Should any of these qualities be missing from the contractor's characteristics, the contractor may be ill prepared to gain the confidence of key project stakeholders and may be unprepared to complete high risk or complex trenchless projects.

Many engineers and owners have worked on projects covering a wide array of trenchless construction methods where the experience of all relevant stakeholders, not just the contractor, has made the difference between whether certain

unforeseen or unfortunate events result in a successful or non-successful project. Engineers often compete with one another to win contracts during the proposals phase. Those with lesser qualifications or dull ideas are weeded out. The bright and innovative engineers may be shortlisted and asked to interview. Owners generally understand the risks involved with trenchless construction and the importance of having highly qualified team members working to design a project with the least risk and greatest flexibility for implementing contingency plans to mitigate against risks inherent to the project and/or chosen trenchless method. For the risks the owners do not understand, they count on their consultants to identify and educate the owner so that they may make important decisions based on a clear representation and quantification of the risks. For the same reasons, engineers and owners often feel a similar code of standards must be applied to selection of the contractors. Thus, minimum prequalifications and/or qualifications requirements are often required of the contractor who may be awarded the construction contract.

Depending on the size and complexity of the project, significant effort may be allocated toward crafting qualifications or prequalification packages. It is the intent of this paper to determine the goals of different prequalification or qualification packages for municipal trenchless construction projects, advantages and disadvantages of different types, and whether those goals were achieved. To accomplish this, a survey was created and sent to various engineers, owners, and contractors to gain additional industry feedback from a diverse group of industry professionals. Discrepancies between commentary provided by the three types of respondents are identified and the reasoning for their thought departure are explored. Upon reading this paper you will be exposed to the diversity of prequalification and qualification packages, goals and effectiveness of various types, and differences in viewpoints from a diverse set of industry professionals. It is the author's hope that this paper leads to greater communication between industry professionals of differing arenas, leading toward streamlined contract acquisition and trenchless industry growth.

3. TYPES OF PREQUALIFICATION OR QUALIFICATION PACKAGES

There are many ways owners and engineers can attempt to eliminate unqualified contractors from working on their project. Most often these strategies take the form of either prequalifying the contractor prior to bidding or award of the contract, or requiring minimum qualifications of the contractor within the contract itself. From here, numerous variations to standard prequalification or qualification packages can be made that differentiate one package from the next. For the purposes of this study, the prequalification and qualification packages are broken down into four root categories, each category containing sufficient flexibility for the owner and design team to influence where the "line of acceptable quality" is drawn in the sand. These four categories are as follows:

Category 1: Prequalification and selection of short list prior to bidding

Category 2: Prequalification as part of the bid package, for review prior to award

Category 3: Qualification requirements within the submittal section of the trenchless specification

Category 4: Qualification requirements within the quality assurance section of the trenchless specification

Category 1 packages include a set of qualifying requirements that the contractor must submit prior to bidding on the project. The Category 1 packages may require the contractor to provide resumes for key personnel along with a list of relevant projects illustrating how the minimum qualifying characteristics are met or exceeded. Once the contractor completes the Category 1 package they send it in for review, and if they meet the minimum requirements they are shortlisted and approved to bid on the work.

Category 2 packages include a set of qualifying requirements included within the bid package. The contractor must fill out the required fields and turn it in with their bid for the work. When the contracting agency reviews all bids, the qualifications will be used to determine if the contractor is considered responsive or non-responsive. Contractors not meeting the minimum qualifications will be considered non-responsive and their bid will be thrown out. Frequently, Category 2 packages only require the lowest two bidders to fill out the qualifications section. The lowest two bidders then send in their qualifications upon being notified. The lowest bidder with a responsive bid is then awarded the work contract.

Category 3 packages include a set of qualifying requirements listed within the submittals section of specification section that requires a minimum level of experience. For trenchless projects, it is often the trenchless specification that requires submittal of the contractor's relevant experience. Submittal and review of the contractor's qualifications occurs after award of the contract, during the submittal review phase. The adequacy of the contractor's qualifications is determined in a similar manner to other submittal requirements, common within municipal construction projects.

Category 4 packages include a set of qualifying requirements listed in the quality assurance section of the specification section requiring the minimum level of experience. The contractor is not required to submit their qualifications for review; however, they are bound by the contract to ensure the minimum qualifications are accomplished. Should a contractor not provide qualified personnel during construction they are in violation of the contract and can be held accountable for not maintaining their contract obligations.

4. SURVEY

The survey was sent to three contractors, six engineers, and six owners to attempt to gain a diversified response. Respondents included three contractors, two engineers, and three owners. The first section of the survey contained definitions of the four categories of prequalification or qualification packages to minimize variation in understanding from person to person. Next, general questions were asked to capture a brief understanding of each respondent's background and preference for prequalification or qualification packages. Following, categorical questions directed at each of the four categories were provided to allow each respondent to describe their own personnel experience with different types of packages. Lastly, concluding questions attempted to spark a more emotional response from the respondents, targeted to identify the respondent's own personal interest on the subject. The questions were as follows:

General Questions:

- 1) What trenchless technologies are you or your firm, company, or municipality most experienced with?
- 2) Approximately how many years have you or your firm, company, or municipality worked in the trenchless industry?
- 3) On a percentage basis, how frequently do you encounter a trenchless project with prequalifications/qualifications?
- 4) Are there any other categories of prequalifications or qualifications that I have neglected to mention that you would like to share?
- 5) Rank the category of prequalifications/qualifications you encounter most frequently (start with most frequent, end with least frequent).
- 6) Rank the four categories of prequalifications/qualifications by favorability based on your personal experiences (start with most favorable, end with least favorable).

Categorical Questions:

- 1) *Category 1 – Prequalification and selection of short list prior to bidding*
 - a) What do you feel is the goal of Category 1 prequalifications?
 - b) Is that goal commonly achieved?
 - c) What are some advantages of Category 1 prequalifications?
 - d) What are some disadvantages of Category 1 prequalifications?
- 2) *Category 2 – Prequalification as part of the bid package, for review prior to award*
 - a) What do you feel is the goal of Category 2 prequalifications?
 - b) Is that goal commonly achieved?
 - c) What are some advantages of Category 2 prequalifications?
 - d) What are some disadvantages of Category 2 prequalifications?
- 3) *Category 3 – Submittal of qualifications required by specification*
 - a) What do you feel is the goal of Category 3 qualifications?
 - b) Is that goal commonly achieved?
 - c) What are some advantages of Category 3 qualifications?
 - d) What are some disadvantages of Category 3 qualifications?

- 4) *Category 4 – Qualifications requirement in Quality Assurance section of specification*
- What do you feel is the goal of Category 4 qualifications?
 - Is that goal commonly achieved?
 - What are some advantages of Category 4 qualifications?
 - What are some disadvantages of Category 4 qualifications?

Concluding Questions:

- Please describe a situation in which you were directly affected by one of the four categories of prequalifications/qualifications and whether that experience was positive or negative, and why.
- Do you have any other comments related to the effectiveness of the prequalifications/qualification categories that you would like to share?
- Is there a topic of interest related to prequalifications/qualifications where further studies might benefit you or others within the trenchless industry?

5. SURVEY RESULTS AND ANALYSIS

General Questions

The survey respondents have experience with trenchless technologies as described in Table 1. All respondents stated their experience with trenchless technologies is greater than 10 years, with the majority being greater than 20 years.

Table 1. Trenchless Technologies Practiced by Survey Respondents

Technology	Number of Respondents		
	Contractors	Engineers	Owners
HDD	3	2	3
Auger boring	2	1	1
Slick Boring	1		
Pipe Ramming	2	1	1
Open Shield Pipe Jacking	1	1	2
Pipe Bursting	1	1	1
Slip Lining	2	1	2
Pilot Tube	2	1	1
CIPP		1	2
Pipe Reaming	1		
CCTV		1	
Microtunnel		1	3
Large Diameter Tunneling			1

Table 2 identifies the number of respondents that encounter some sort of prequalification or qualification package with their trenchless projects. What is interesting to note is the clear discrepancy between the owner/engineer and contractor frequency of occurrence. Owners and engineers stated they frequently use some sort of prequalification or qualification package, yet the contractors are obtaining a significant portion of their work without having to prove qualifications. It is reasonable to assume that the contractors have been able to procure private work to supplement their public municipal projects. It would be intriguing to know contractors' preferences toward private or public contracts and how that varies by size of the construction company. The Contractor that listed a 51 to 75 percent occurrence is of a medium size. The contractor listing 0 to 25 percent is large. The other contractor listing 0 to 25 percent is small/medium, but has preferred private work as of late due to increased competition and low market prices on public work in his area.

Table 2. Percent Occurrence of Trenchless Projects with a Prequalification or Qualification Requirement

% Occurrence	Number of Respondents		
	Contractors	Engineers	Owners
0 to 25	2		
26 to 50			
51 to 75	1		1
> 75		2	2

When asked if there were any other categories of prequalification or qualification packages one respondent, one contractor stated that some owners invite only their preferred contractors. Essentially, the owner has effectively performed their own prequalification without documented input. It is the author’s opinion that this sort of prequalification, a boy’s club, if you will, may be more prevalent in the private industry. Future studies may wish to explore this hypothesis to determine if this plays a role in the general contracting body’s preference to either private or public contracts.

Table 3 displays the results of General Question 5, an average ranking of the frequency of occurrence of the four categories of prequalification or qualification packages. Contractors, engineers, and owners experienced Category 3 qualifications most frequently. It was found that in certain states it is not legal to use Category 1 prequalification packages for publicly funded projects.

Table 3. Frequency of Occurrence Ranking for Categories of Prequal/Qual Packages for Trenchless Projects

Frequency	Contractors	Engineers	Owners
Most	3	3	2 & 3
↓	1	1	2 & 3
	2 & 4	4	4
Least	2 & 4	2	1

Table 4 displays the results of General Question 6, an average ranking of the favorability of the four categories of prequalification or qualification packages. It makes logical sense that the owners preferable method qualifying contractors is also the most frequent form of qualifications package experienced. After all, owners are the group responsible for approval of the contract and its components.

Table 4. Favorability Ranking for Categories of Prequal/Qual Packages for Trenchless Projects

Favorability	Contractors	Engineers	Owners
Most	2	1	2 & 3
↓	1	4	2 & 3
	3	3	1 & 4
Least	4	2	1 & 4

Categorical Questions

Survey results and author’s opinions for each category of prequalification/qualification package will be fully discussed prior to moving on to the next category. Category 1 will be discussed first, following in sequential order.

Category 1 - Prequalification and selection of short list prior to bidding

There were two goals for Category 1 packages that were repeatedly identified by the survey respondents: separating the prequalification process from bidding, and obtaining a known bidding pool prior to bidding. For the owner and engineer, knowing the bidding pool prior to the bidding phase allows for adjustments should the results of the

prequalification process be unfavorable. For the contractor, knowing the list of approved contractors for upcoming work contracts allows them to better allocate bidding effort as required to better suit their bidding competition.

There were numerous advantages and disadvantages listed in the survey results, as listed in Table 5.

Table 5. Category 1 Pros and Cons

#	Advantages	Disadvantages
1	Eliminates “cowboys” or unqualified contractors	May not include contractors with unique means and methods
2	Does not increase risk of bid protest	May diminish competition too quickly
3	Greater owner confidence in contractor	The “extra work” required to prequalify may discourage some otherwise qualified contractors
4	Provides owner with detailed info on niche markets	An otherwise qualified bidder may be left out or miss the prequalification process due to timing or any other number of reasons
5	Allows bidders to gauge their bidding competition more precisely	The process typically takes longer than other categories
6	Provides longer review period	
7	Promotes greater investment from the prequalified contractors during bidding phase (levels the playing field)	

Having a known list of bidders prior to bid and being able to effectively eliminate unqualified contractors without risk of bid protest were the two most frequently listed advantages (a known list of bidders was also identified as the goal). The contractors expressed another advantage was that Category 1 packages allow for a longer review period. It is slightly peculiar that the groups responsible for the review did not list this as an advantage as well; however, owners and engineers may feel the review periods for other categories are acceptable and the additional review time is unnecessary, or the contractors may appreciate the extra time engineers and owners provide in the review of Category 1 prequalifications.

The most frequently occurring disadvantage was the possibility of mistakenly leaving out or missing an otherwise qualified bidder due to timing, poor advertisement of the prequalification process, or for any other reason. One of the contractors, a company of small to medium size, listed an example where a city near him prequalifies contractors for each type of construction work in advance of the calendar year for the entirety of that calendar year. He expressed that a contractor may miss an opportunity to work on pilot tube microtunneling jobs if the contractor filled out the prequalifications for microtunneling work, but didn’t realize there was a separate identifier for pilot tube microtunneling.

The author found it interesting that a contractor for a large construction company felt Category 1 packages were favorable and did not place extra burden on their work procurement efforts, while a smaller contractor stated the opposite opinion. It may be easier for a larger construction company to allocate effort into prequalifying for projects that have not yet entered the bidding phase. Smaller construction companies may not have the resources to identify and execute prequalification opportunities separate from the bid process.

The author believes Category 1 to be very affective at eliminating unqualified contractors, but with the expense of reduced bidding competition. Category 1 prequalifications must be well thought out and on target to achieve the desired balance between limiting the bidding pool and obtaining a qualified list of contractors.

Category 2 - Prequalification as part of the bid package, for review prior to award

The most frequently listed goal of Category 2 is the ability to streamline the prequalification and bidding processes into one phase, saving time in the long run. Other goals that were identified and worth noting include: allowing anyone to bid, but clearly identifying prequalifications required for approval; lessening the potential for manipulation of qualification parameters post-award; providing an avenue to refrain from award to an unqualified lowest bidder. One

of the owners expressed that Category 2 can work effectively, but it strongly depends on the quality and precision of the requirements themselves and on objectivity and completeness the reviewer's work.

Pros and cons of Category 2 are listed in Table 6.

Table 6. Category 2 Pros and Cons

#	Advantages	Disadvantages
1	Streamlines prequalification and bidding periods	Increased possibility of bid protest
2	Easier to reject an unqualified firm prior to award than after	Difficulty in pinpointing appropriate level of prequalifications during their draft
3	Little effort required of owner/engineer/contractor during bidding process	Contractors not meeting prequalifications exactly, say 99%, may be discouraged from bidding
4	Owner ensured of qualified contractor prior to award	How strict should the reviewer be if lowest bidder is unqualified?
5	Owner has greater confidence work will be constructed as designed	Not being able to accept the low bidder if low bidder is unqualified (higher contract price results)
6	Generates conversation between contractor/owner regarding contract concerns	Little time available for review of prequalifications

The most frequently identified advantages were a streamlined bidding/prequalification process and the decreased level of effort required of all parties. The most frequently identified disadvantage was possibility of a bid protest. There is little doubt that in absence of bid protest, Category 2 would save time over Category 1. That is why it is of extreme importance that prequalification requirements are appropriately selected and bidders' prequalifications are independently verified and reviewed objectively and literally. If the apparent low bidder's prequalifications are reviewed in a discretionary manner and found to meet the intent of the requirements, but may not meet all requirements in a literal manner, the bid may be protested by another bidder.

Category 3 - Qualification requirements within the submittal section of the trenchless specification

The most frequently identified goal for Category 3 was to inform the contractor during bidding of the qualification requirements. It is important the contractor bases their bid using quotes from qualified subcontractors. A second repeat goal was to ensure a qualified contractor performs the contract work. One of the owners suggested that Category 3 works well when the trenchless work is a small component of a much larger contract.

Table 7 lists advantages and disadvantages for Category 3.

Table 7. Category 3 Pros and Cons

#	Advantages	Disadvantages
1	Does not slow down bidding process, yet informs bidders of qualifications requirements during bidding	How do you handle a qualifications submittal that does not meet the requirements?
2	General contractor has greater flexibility when selecting their subcontractors	Enforcement of the qualifications requirements and daily monitoring during construction by the construction management (CM) team is required.
3	Reviewer can review qualifications along with the contractors work plan submittal	There is no guarantee that the submittal package is entirely accurate.
4	Less upfront paperwork may encourage more bidders	
5	Provides the owner some assurance that a competent entity will do the work	

The most frequently listed advantage was that Category 3 does not slow down the bidding process, yet still informs bidders of the required qualifications during the bidding phase. It is clear the level of control over the contractor's qualifications is reduced moving from Category 2 to Category 3. A decreased level of control might be valuable in a situation where a project does not exhibit extraordinary risks or complex planning, or if little is known about the construction market for the respective project.

A reoccurring disadvantage from the survey results was what to do should a qualifications submittal be found to fall short of the required qualifications. How many iterations of revise and resubmit is the CM team willing to go through to ensure these requirements are met? Even if the reviewer takes no exceptions to a revised submittal now meeting the qualifications requirements, the CM team must continuously monitor the contractor during construction to ensure the personnel on the job matches the submitted qualifications. Additionally, how would the general contractor react if they used a quote from a subcontractor, unknown to be unqualified to the general, then the general is directed to seek a new subcontractor with higher qualifications and presumably a higher price point?

Another important disadvantage to Category 3 is that post bid submittals for qualifications are harder for owners/engineers to enforce. This can place the contractor in an uncomfortable situation. How does the contractor bid the work, with a reasonable yet higher price that accounts for necessary means and methods in the hopes that inexperienced contractors who did not plan for proper contingencies are not allowed to participate due to insufficient qualifications, or skimping on contingency funds to compete with other low bids?

Category 4 - Qualification requirements within the quality assurance section of the trenchless specification

Three goals for Category 4 were listed in the survey results: ensuring the installed product meets owner’s requirements, keeping quality in the realm of the contractor’s responsibility, and limiting time and level of effort required during the bidding and submittal phases. It is interesting to note that 2 out of 3 owners and 1 out of 3 contractors conveyed there was little difference between Category 3 and 4. If the requirements are in the contract, they are in the contract and enforceable by law. The only difference between categories 3 and 4 would be the actual submittal and review of the contractor’s qualifications, but enforcement of inadequate qualifications is difficult either way.

Table 8 lists advantages and disadvantages for Category 4.

Table 8. Category 4 Pros and Cons

#	Advantages	Disadvantages
1	Contractor is in control of quality and can be consistent with their means and methods	The owner/engineer and CM team have the least control over qualifications of the entity performing the work.
2	Not having to produce qualifications may promote a greater quantity of bidders	The importance of minimum qualifications is significantly reduced
3	A contractual obligation to fulfill the minimum qualifications requirements remains	Difficult to prove a contractor unqualified when submittal of qualifications is not required
4		Relies on the honor system

There were no repeat advantages to Category 4. The lack of control by the CM/owner to enforce qualification standards was listed as a repeat disadvantage. From Table 4, Category 4 was least favorable by contractors and owners. Contractors may not like Category 4 since it does not weed out unqualified contractors and may make it more difficult for them to win the job. It is likely that if there were unqualified contractors during the bidding process, a lesser-qualified contractor is one of the lowest bidders.

Concluding Questions

Three concluding questions were asked to provide opportunity for each respondent to describe their personal experiences with different types of prequalification or qualification packages without being confined to highly structured questions.

Question 1 – Describe a personal experience related to the effectiveness or ineffectiveness of a prequalification/qualification package...

Category 1

An engineer provided an example of when the “bar” was set too high for a Category 1 prequalification package. All three submitting companies were judged to be qualified, but did not meet the rigid literal interpretation of the qualification requirements. On one hand the owner was able to filter the allowable bidders effectively; however, if

one of the bidders did literally meet all the requirements perfectly and all bidders were deemed qualified in the end, unwanted protest from the only bidder truly meeting the qualifications may have resulted.

A contractor provided a positive and negative experience with Category 1. The positive experience occurred when stringent prequalification requirements for a large-scale HDD project resulted in only two qualified bidders. The contractor believes the bids were still competitive, and both contractors were highly qualified and experienced, giving the owner a level of comfort that the project would be completed successfully. The negative experience was when stringent requirements on a large-scale design build HDD project resulted in only one qualified bidder. The owner, a public utility, chose to proceed, but when the bid was opened they temporarily canceled the project, citing they could not verify the price was appropriate for the scope of work. The project was advertised one year later with weaker qualification requirements.

Category 2

An engineer provided an example where the submitted information was difficult to verify, but was judged by the reviewer as qualified. The difficulty in verifying the experience could have resulted in a bid protest; however, it wasn't in this case. The contractor ended up getting award and executed the work with no issues.

One owner expressed that he has had construction companies tell him they did not meet the qualifications and therefore did not bid the job, reducing competition. This could be a positive, by weeding out unqualified contractors, or the reduced competition may have resulted in a higher contract price. This speaks to the importance of being able to accurately target the difficulty of minimum prequalification requirements to attain the desired effect.

Another owner expressed they have had good luck with submittals and review of qualifications as part of the bid process and prior to award. They did have one instance for a lining project where the prequalifications were not met by the lowest bidder. They were provided opportunity to bring in outside personnel to meet the qualifications. Remarkably, the owner did not experience protest from the 2nd lowest bidder.

The third owner expressed that issues may arise with Category 2 if the CM team does not ensure that the approved entity and personnel are the ones on-site completing the work. The author feels this is true with all forms of prequalification or qualification packages.

Category 3

An engineer stated they most often use Category 3, and it has worked well for them in their relatively small northern market. They use this type of qualification package for CIPP, pipe bursting, and HDD technologies. It allows their general contractors to be notified that the contract contains specialized work and they need to use a qualified subcontractor.

A contractor provided a negative experience involving a Mid-size HDD project. The contractor was required to submit qualifications during the submittal phase after project award. A small contractor with the lowest price was awarded the project. Their HDD rig was grossly undersized and not capable of providing the power required to successfully complete the longer crossings. They hired another HDD contractor to complete the remaining crossings.

Another contractor stated that on several occasions the qualification requirements for Categories 3 and 4 were buried in the specifications, resulting in projects having to be re-bid or otherwise accommodated. It is the author's opinion that engineers and owners should make every effort possible to ensure the qualification requirements so they are easy to see during bidding.

Category 4

There were no specific examples provided for Category 4.

Question 2 – Do you have any other comments?

An engineer expressed that depending on project complexity, project risk, bidding climate, etc. that any of the prequalification/qualification categories could be appropriate for use. An owner expressed their goal is to have an efficient method for both owner and contractor that also ensures a qualified contractor performs the contract work. A different owner conveyed that the most important thing is that the design team, submittal reviewer, and CM work diligently to ensure the correct qualification requirements are drafted and enforced during construction. Often, projects get into trouble, and/or claims are filed, due to a critical leg of the design not being followed during construction. One of the larger contractors proclaimed they feel Category 1 usually yields the best results, although it does take more time and effort on the front end.

An engineer stated it may be worth considering the technical capabilities along with financial capabilities, insurability, and safety record as part of a contractor's qualifications. There are some lines of thinking that if the contractor is financially available and insurable, then they are technically qualified because their insurance and financiers would not otherwise allow them to do the work. One contractor also suggested parameters such as good financial backing, years of underground experience, quality workers, and strong working relationships with equipment manufacturers and suppliers can also provide comfort the contractor will likely succeed. A different contractor would like to see safety, financial responsibility, and recommendations from owners/engineers elevated in the hierarchy for qualification consideration. He continued that the purpose of qualification requirements are to best assure competency at the worksite, without unduly restricting entry.

One contractor expressed that every trenchless contractor out there has had a "first job", and experience doesn't guarantee competence or willingness to cooperate should a difficult situation develop in the field. The author has seen several examples where a competent, highly experienced contractor has played the legal game, building up significant delay costs and leaving the owner without a finished project. This happened not because the contractor couldn't do the work, but because compensation for certain difficulties could not be agreed upon by all parties.

Another aspect to ponder came from a contractor. Why is the experience time frame, say within the last five years, so important? Should it matter if some of the experience was gained over five years ago, especially if the contractor can prove that the same personnel would be used? Additionally, specific job challenges should be included in qualification requirements (i.e. grade critical sewer, presence of groundwater, alignment challenges, and entry or exit point difficulties). Often, the minimum quantifiable qualifications required are very specific and may not be effective in accomplishing the intended goal of obtaining a qualified contractor. For example, a minimum qualification requirement may be 1000 LF of 16-inch diameter pipe or larger. With this requirement a resume with 950 LF of 18" and 1200 LF of 14" would not meet the literal interpolation of the minimum qualification. How should that be handled? A discretionary review may be favorable to that contractor, but may result in a bid protest from a competitor.

Question 3 – Topics of interest for future studies...

One owner feels there is a need for increased communication between owner, engineer, and the CM team during development of the minimum qualification requirements package. Additionally, consistency from project design to enforcement of the design during construction is a must. This includes the necessity for consistency during staff changes of CM personnel.

One contractor expressed that setting the minimum qualification requirements appropriately for a given project while considering the market's experience and abilities is difficult. Occasionally the qualifications are set such that no one can meet them. It is very important to understand the current state of the market, while not appearing to set the bar based on one specific company's achievements. This is a real challenge.

7. CONCLUSION

A summary of key advantages and disadvantages of each category of prequalification/qualification package are provided in Table 9.

Table 9. Key Advantages and Disadvantages of Each Category

Characteristic	Category 1	Category 2	Category 3	Category 4
Advantages	Generates a known list of acceptable bidders prior to bidding phase.	Effective at limiting acceptable bidders to those above minimum qualifications. Streamlined effort for all parties when implementing a prequalification strategy.	Quickest process allowing for evaluation of qualifications.	May promote greater competition during bidding. Contractual requirement to meet minimum qualifications exists.
Disadvantages	Possibility to unnecessarily reduce bidding competition. High consequence for inappropriate minimum qualifications. Lengthens duration prior to award of contract. Certain states may not allow Category 1 for publicly funded projects.	Possibility for bid protests is increased.	Difficult to enforce. Requires diligent effort by CM.	CM/owner have least control enforcing minimum qualifications.

Key areas of interest remaining include:

- Allowing contractors to meet minimum requirements by hiring qualified assistance might achieve the goals of the prequalification or qualification process while allowing lesser experienced contractors to get involved that may have innovative ideas.
- Ensuring a contractor exceeds certain quantitative stats reflecting their experience with a certain technology does not guarantee that they have strong financial backing, can clearly articulate construction difficulties with engineers, and can effectively implement contingency plans. Further research should be directed to evaluate the effectiveness of including alternative qualities for potential bidders. There are some lines of thinking that if the contractor is financially available and insurable, then they are technically qualified because their insurance and financiers would not otherwise allow them to do the work.