CITY OF Grand Junction COLORADO

Purchasing Division

ADDENDUM NO. 1

DATE: **May 24, 2018**
FROM: **City of Grand Junction Purchasing Division**
TO: **All Offerors**
RE: **Persigo Wastewater Treatment Plant Diffuser Outfall Improvements Project (RE-BID) IFB-4534-18-DH**

Offerors responding to the above referenced solicitation are hereby instructed that the requirements have been clarified, modified, superseded and supplemented as to this date as hereinafter described.

Please make note of the following clarifications:

1. Q. Are there any restrictions for the 404 permit?

   A. No. Nationwide Permit (NWP) 39 Commercial and Institutional Developments, has been acquired for this Project. A copy of the permit will be provided to the Contractor prior to work beginning. The City will keep a copy of the NWP on-site during construction for reference.

2. Q. For bypass pumping, is Contractor required to have double or triple redundancy?

   A. Yes, the Bypass Pumping pay item shall include at least one backup pump and pump controls. See Specification 01095, Bypass Pumping, Pay Item #16.

   The first paragraph in Special Condition 3.3.32 shall be replaced with the following paragraph:

   > *Bypass pumping of the treated effluent water during the concrete wall coring, concrete pipe plugging operations, and the diffuser testing phase will be required. The Contractor will be required to provide onsite monitoring of the bypass pumping operation and equipment 24 hours a day while the pumps are in operation. The Contractor will be required to provide all necessary equipment for successful bypass pumping of the effluent flows and shall include, but not limited to, primary pump(s), one backup pump, backup controls, pipe manifold, suction and discharge piping, 48-inch pipe plug, fuel, labor, and materials for continuous operations of the bypass pumping assembly.*

3. Q. Are there any Raptor (birds of prey) nests to contend with on the south side of highway?

   A. No.

4. Per CDOT, the "Intermediate Pit" in the I-70 median cannot be used for a launching pit for the boring operations. The intermediate pit can only be used as an observation pit, equipment maintenance pit, and/or receiving pit. CDOT will not allow the Contractor to have a bunch of boring equipment and pipe material staged in the median.

   Contractor's need to be aware that CDOT may require left lane closures on interstate in vicinity of intermediate pit if Contractor is needing to access the intermediate pit multiple times a day.

5. An updated Section 02440, Pipe Jacking specification is included with this Addendum #1.

6. Replace the construction plans with the updated construction plans that are attached to this Addendum. The updated construction plans include the following change(s):

   A. Sheet 2 of 18, Project Location Map, has been updated with current contact information.
   B. Sheet 18 of 18, Monitoring Plan, has been added to the construction plan set.

   Contractor's need to be aware that CDOT may require left lane closures on interstate in vicinity of intermediate pit if Contractor is needing to access the intermediate pit multiple times a day.

7. Q. What is the wall thickness of the steel casing pipe?

   A. Refer to Part 2, Products within Specification 02315, Steel Casing Pipe, for this information. This specification states that the minimum wall thickness for the steel casing pipe shall be 0.75" and shall be fabricated in accordance with AWWA C-200.

8. Q. Will surveyors be required to be on site at all times during boring?

   A. No. Refer to Specification 02445, Instrumentation and Monitoring, for monitoring frequencies.

9. Q. Can you highlight the major changes from this solicitation scope as compared to the last?

   A. The City worked with CDOT on getting permission to work within the interstate right-of-way to allow for shorter bore lengths. The boring tolerances have been adjusted. The allowed construction period has been increased. Pipe invert elevations in manholes upstream and downstream of casing pipe/carrier pipe have been changed. Interstate pavement monitoring plan has been changed for when the bore is happening.

10. Q. What would be an acceptable equivalent to 48" RCP?

A. SaniTite HP Gravity Flow Sanitary Sewer Pipe by ADS or an equivalent manufacturer.

11. Q. How stringent are the 100' easements in the right of way?

A. On land, the Contractor will need to stay within the easement boundaries. Out in the river, it may be hard during construction of the coffer dam to stay within the easement boundary. The Colorado Parks and Wildlife are fine if the diffuser work out in the river extends beyond the easement boundaries.

12. Q. What is the surveying control?

A. Survey control is the same as the initial survey completed for this Project. Project Control Points are provided on sheet 5 of 17. It is the Contractor's responsibility to determine if additional survey control points need to be set to accommodate construction activities.

13. Q. Can you please verify the I.D. for the manholes to be used on the project?

A. Manhole Slab Bases shall be constructed per CDOT Standard Detail M-604-20. From the minimum bench dimensions shown in the details (9-inches), and using 48-inch I.D. pipe, it appears that the minimum diameter for manholes can be either 66-inch diameter or 72-inch diameter, whichever the precast supplier is able to fabricate.

14. Q. Will the geotech and construction materials testing be contracted through the City or the General Contractor?

A. Per Special Condition 3.3.21, the City will be hiring a 3rd party Quality Assurance testing agency for backfill compaction testing, concrete testing, and any other tests that are deemed necessary per the specification requirements.

The Contractor shall provide any Quality Control testing and/or inspection as required by the project specifications/manual in Appendix B.

15. Q. Does the Project require the Contractor to survey the river channel/bottom before diffuser installation and after diffuser installation?

A. Per the USACOE 404 permit and stormwater management plan notes, the river shall be returned to its pre-construction course, condition, capacity, and location.

16. Q. What size rock/cobble shall be used for the baseline for the boring operation?

A. The baseline rock/cobble size to be used for the boring operation is 12-inches.

17. Q. What survey monuments will be required to be replaced?

A. *At this time, the City believes the only monument that will need to be replaced is the Persigo property boundary pin at the southwest corner of the property. The Survey Monumentation pay item is to be used for referencing and resetting this property pin if it is destroyed during construction.*

18. Q. The 61.5" OD casing as spec'd is a non-standard size for tunnel equipment. Will an upsize in casing diameter be allowed?

A. *Upsizing the steel casing diameter will be permitted. The 61.5-inch OD is based upon the carrier pipe and casing spacers with an allowable tolerance. A 48-inch ID HDPE carrier pipe is controlling factor for the hydraulic design.*

19. Q. Is there a specification for the casing spacers or is it up to the Contractor to design?

A. *Refer to Section 02715 and Drawing C501 Detail 2. The contract documents provide requirements for the casing spacers which shall be designed by the Contractor to meet their means and methods.*

20. Q. Will the qualifications for the Tunnel Subcontractor be required to be included with the bid?

A. *Refer to specification 023216.1.6.A for pipe ramming contractor requirements, specification 02440.1.6 for pipe jacking contractor and specification 02623 for microtunneling. A subcontractor qualification form will be required with bid submittal and is part of Addendum #1.*

21. Q. Are Pipe Ramming and Pipe Jacking allowable methods even though the geotechnical report recommends Micro-tunneling as the preferred method?

A. *Pipe Ramming and Pipe Jacking are considered allowable methods.*

22. Q. Should Section 02623.1.4 Project Conditions under the Mirco-tunneling section (also in the Pipe Ramming Spec) also be included in the Pipe Jacking specs?

A. *Project Conditions are the same for micro-tunneling, pipe jacking and pipe ramming. The Project Conditions will be added to Specification 02440 – Pipe Jacking.*

23. Q. Why are there greater grade tolerances allowed for the Pipe Ramming (1') than for either the Pipe Jacking (6") or Micro-tunneling (6") methods?

A. *Pipe ramming allows for a greater tolerance based upon the achievable tolerance of the trenchless technology based upon industry best practices. Pipe Jacking and Micro-tunneling technology has the ability to achieve tighter tolerances in comparison to Pipe Ramming.*

24. Q What is the minimum wall thickness for the 61.5" casing for the Pipe Ramming?

A. Use ¾ inch minimum. The Contractor shall determine the actual pipe thickness per Specification 02315.1.3.E.1. See specification section 02315 Part 2.A.

25. Q. What is the timing required for bypass pumping?

A. Per Measurement and Payment Item 17, bypass pumping required for connection of the effluent structure.

26. Q. Can work go 24 hrs/day during the boring process?

A. The City will support the boring operation going 24 hrs/day, if necessary. The City and Contractor will have to first get CDOT's support for working 24 hrs/day within CDOT right-of-way. The Contractor is responsible for acquiring the CDOT Utility Permit for work within the right-of-way and the hours of operation for the bore can be discussed then with CDOT.

27. Q. Replace Section 3.6 in the Statement of Work section with the following:

3.6 Contractor Bid Documents: For Contractor's convenience, the following is a list of form/items to be submitted with the Contractor's bid response. However, should a form/item not be listed in this section, but required in the solicitation documents, it is the Contractor's responsibility to ensure all forms/items are submitted.

- Contractor's Bid Form
- Contractor's Bid Bond
- Price Bid Schedule
- Subcontractor Statement of Qualifications for boring method being proposed.

The original solicitation for the project noted above is amended as noted.

All other conditions of subject remain the same.

Respectfully,

Duane Hoff Jr., Senior Buyer
City of Grand Junction, Colorado

Section 02440
Pipe Jacking

PART 1 GENERAL

1.1 Summary

1.1.1 This section covers Pipe Jacking for installation of the 60 inch Steel Pipe. Excavation may also be conducted by other tunnelling methods specified in the Contract Documents and is to be determined by the Contractor.

1.1.2 The Contractor shall furnish all materials and equipment necessary for installation of the Steel Pipe as shown on the Contract Drawings and is responsible for selecting their means and methods for completing the installation of the Steel Pipe in compliance with the specifications.

1.1.3 Open-shield pipe jacking shall include fabrication, transportation, testing, installation, and launch of the open-shield pipe jacking equipment; installation and use of all other pipe- jacking and excavation equipment; the excavation, handling, removal, and disposal of all materials encountered in the tunnel excavation; installation of Steel Pipe where shown in the drawings or specified in the contract documents; collecting, treating, and conveying all tunnel construction water according to local and regional protocols; provision of all temporary drainage, tunnel ventilation, lighting, wiring, and all other utilities; tunnel safety; environmental protections and all appurtenant work necessary to complete the work in accordance with the Contract Documents.

1.1.4 The excavated diameter of the tunnel shall be determined by the Contractor based on its selected construction means, methods and equipment, subject to the limitations as shown on the Contract Drawings or stated elsewhere in the Specifications. Excavate the tunnel to the selected size; to the line and grade to allow the Steel Pipe pipes to be placed using pipe jacking methods to the line indicated on the Drawings; and to within the tolerances specified herein.

1.2 Related Sections

1.2.1 Section 01130 – Dewatering

1.2.2 Section 02315 – Steel Casing Pipe

1.2.3 Section 02356 – Steel Sheet Piling

1.2.4 Section 02445 – Instrumentation and Monitoring

1.2.5 Section 02621 – Shaft Construction

1.2.6 Section 03360 – Contact Grouting

1.3 Reference Specifications, Codes, and Standards

1.3.1 ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils

1.3.2 ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.3.3 OHSA - Occupational Health and Safety Act (OHSA) Regulations for Construction Projects; Tunnels, Shafts, Caissons, and Cofferdams, S. 243-331.

1.4 Definitions

1.4.1 Open-Shield Pipe Jacking: For the purposes of this specification, open-shield pipe jacking is defined as a technique for installing pipe by jacking it into place from a jacking shaft to a receiving shaft, using hydraulic jacks. Soil excavation is performed within a shield in front of the lead pipe segment using hand-mining, mechanical methods such as a digger-boom, or with mechanized equipment such as a tunnel boring machine (TBM). The open shield allows access to the excavation face from inside the bore. The shield is steerable using hydraulic jacks to orient an articulated section of the shield, and guidance can be provided using a laser or theodolite system. Pipe jacking with an Earth Pressure Balance capable TBM operating in open-mode is considered a form of open-shield pipe jacking.

1.4.2 Jacking Pipe: The pipe jacked behind the shield. The jacking pipe shall be specifically designed to be installed by pipe jacking to meet the final design requirements.

1.4.3 Intermediate Jacking Station (IJS): A fabricated steel cylinder fitted with hydraulic jacks spaced around the circumference, which is incorporated into the pipeline between two specially fabricated pipe sections. The function of an intermediate jacking station is to distribute the jacking load along the pipe string during pipe installation. The hydraulic jacks are removed at the completion of a drive and the gap between adjacent pipe sections is fully closed by pushing the pipes together with the main shaft jacks or another IJS. The steel cylinder remains as an extended sleeve or coupling. The steel cylinder must be protected from corrosion, consistent with corrosion protection used for the jacking pipe and joints.

1.4.4 Launch/Retrieval Seal or Entry/Exit Seal: A mechanical seal usually comprised of one or more rubber flanges attached to a steel housing that is mounted to the wall of the jacking/receiving shaft. The shield or jacking pipe distends the flange seal as it passes through, creating a seal to reduce water, lubrication, and soil inflows into the shaft during pipe jacking operations.

1.4.5 Lubrication/Grout Port: A port located within the shield or in a jacking pipe segment, fitted with a one-way valve, for injection of lubrication material or grout into the annular space between the pipe and the ground. Lubrication ports within the pipe are typically threaded to accept lubrication/grout fittings. Pipe plugs are inserted after grouting is completed. A lubrication station consists of an array of lubrication ports at shield or pipe positions.

1.4.6 Obstruction: See 3.4 for definition of obstructions.

1.5 Submittals

1.5.1 Procedures: Refer to Section 01330, Contractor Submittal Procedures

1.5.2 Qualifications:

1.5.2.1 Submit documentation that the requirements of 1.6 Quality Control have been met.

1.5.3 Informational Submittals:

1.5.3.1 Pipe Jacking Equipment: Submit the following describing the pipe jacking equipment and construction methods:

1.5.3.1.1 A detailed description of the methods and equipment to be used in completing each pipe jacking drive.

1.5.3.1.2 The excavation diameter based upon the outermost dimensions of the gauge cutters or shield. Also, provide the radial overcut which shall be determined as the difference between the maximum excavation diameter and the outer diameter of the jacking pipe, divided by two.

1.5.3.1.3 Manufacturer's literature describing the pipe jacking system including the TBM or shield and all ancillary equipment. Provide descriptions of at least two projects on which this system has been successfully used including names, current addresses, and telephone numbers of The City's representatives for these projects as well as lengths, diameters, soil conditions, and pipe materials used. If a used or refurbished TBM or shield is proposed, list previous usage, modifications made and dates of modifications, and detailed description of the extent and dates of refurbishment. Include the following information concerning the TBM or shield:

(a) Dimensions.

(b) Torque, Thrust, rotation speed range, and all specifications for mechanical equipment used.

(c) Cutter types, configuration, and gauge cutter setting for overcut.

(d) Articulation and steering capability.

(e) Cutterhead jets/ports information, locations, and sizes.

(f) Face accessibility and plate or flood door provisions.

(g) Tail seal details.

(h) List of spare parts and their lead time in case of damage.

(i) Material Safety Data Sheets (MSDS) for all consumables used including but not limited to tail seal grease.

1.5.3.1.4 A description of the alignment control (guidance) system. Provide manufacturer's literature and Drawings, showing setup and support provisions, and other details for the laser or theodolite system. Submit a description of surveying methods to set guidance system positions and a description of procedures to check and reset or realign guidance system during construction. Submit a description of methods to ensure that thrust block, launch seal, and jacking frame are installed on proper line and grade. Confirm that these systems can achieve the required line and grade within the specified tolerances. Submit the template for reporting daily tunnel advance, Horizontal & Vertical deviations from tunnel designed alignment after each "push".

1.5.3.1.5 Ventilation and air quality monitoring system, including monitors for shield or TBM deactivation and alarm activation. Include provisions to check and control dust in vicinity of all personnel working underground.

1.5.3.1.6 Submit results of line and grade survey to ensure that the thrust block, jacking frame, and launch and retrieval seals are installed properly, prior to launch.

1.5.3.1.7 Capacity, number, and arrangement of main jacks. Provide details of thrust ring, thrust block, jacking frame, jacking controls, pressure gages, and jack calibration data (pressure vs. force relationship for each stage of the jacks).

1.5.3.1.8 Details of pipe lubrication injection system and pipe lubricants to be used during pipe jacking, including manufacturer's literature and MSDS sheets. Include a description of proposed lubrication procedures during jacking, including estimated volumes of lubricant that will be pumped. Confirm that sufficient volume of lubricant will be pumped at all times to completely fill the annular space outside the jacking pipe.

1.5.3.1.9 Details of spoil removal and handling systems, transport, and disposal equipment and procedures including spoil disposal sites. Provide written documentation from the disposal site(s) indicating that they will accept the spoil and are in compliance with applicable regulations.

1.5.3.1.10 Drawings and design details for intermediate jacking stations, indicating number required, shell materials, proposed spacing, criteria for installing, and method of operation.

1.5.3.2 For used and refurbished TBM or shield only, the Contractor shall submit the following:

1.5.3.2.1 Certification in writing that the TBM or shield has been refurbished and reconditioned to meet the requirements of this Section. This shall include but not be limited to motors, jacks, hydraulics, mechanical components, bearings other than the main bearing, seals, electrical, electronic and other major components of the TBM or shield and back-up equipment. The certification shall include a statement on expected remaining main bearings and bearing seal life hours and adequacy to complete the work without bearing and seal replacement.

1.5.3.2.2 Qualifications of machine rebuilder demonstrating that the TBM or shield rebuilder has rebuilt TBMs or shields of similar type, size and complexity, used in successfully completed, similar size projects.

1.5.3.3 Shaft Layout Drawings: The Contractor shall submit shaft layout drawings detailing dimensions and locations of all equipment, including overall work area boundaries, crane, front-end loader, forklift, spoil stockpiles, spoil hauling equipment, jacking frame, pumps, generator, lubrication plant, pipe storage area, tool trailer or containers, sound baffles, fences, site offices, first aid cabins, parking areas, and staging area. Shaft layout drawings will be required for jacking and receiving shaft locations and shall be to scale, or show correct dimensions. The Contractor's layout drawings shall show that all equipment and operations shall be completely contained within the allowable work areas shown on the Drawings.

1.5.3.4 Schedule: Provide a schedule for all pipe jacking work, identifying all major construction activities as independent items. The schedule shall include, at a minimum, the following activities: obtain licenses, utility locates and permits, site preparation, mobilization, installation of instrumentation, shaft excavation and support, working slab construction, thrust block construction, jacking equipment setup, entry/exit seal installation for launch/retrieval of shield, pipe jacking, retrieval of the shield, shaft backfill, site restoration, cleanup, and demobilization. The schedule shall also include the work hours and workdays for each activity, and a written description of the construction activities. The schedule will be reviewed by the Contract Administrator and shall be updated and resubmitted by the Contractor every two (2) weeks or more frequently if requested by the Contract Administrator.

1.5.3.5 Calculations: Calculations shall be submitted in a neat, legible format. Assumptions used in calculations shall be consistent with information provided in the Geotechnical Report. All calculations shall be prepared by a professional engineer licensed in Colorado, who shall stamp and sign calculations.

1.5.3.5.1 Design calculations demonstrating that the proposed jacking pipe is capable of supporting the maximum stresses to be imposed during jacking. The calculations shall take into account ground and hydrostatic loads, jacking forces, external loads such as live loads due to traffic, and any other loads that may be reasonably anticipated during jacking. All loads shall be shown and described. Include assumed maximum drive length. Additionally, provide an estimate of the maximum jacking force expected to complete each drive, accounting for both face pressures and frictional resistance along the pipe string.

1.5.3.5.2 Calculations demonstrating that the ground support system and soils and installed reaction piles, if used, behind the thrust block, or other thrust reaction element, can transfer the maximum planned jacking forces exerted by the main jacks to the ground during pipe installation with an acceptable factor of safety of at least 1.5, without excessive stresses, deflection, or displacement.

1.5.3.6 Jacking Pipe: Detailed drawings of the jacking pipe indicating the location and spacing of lubrication/grout fittings, joint details, joint cushioning materials, gaskets, and intermediate jacking station pipe details. Indicate the ultimate and allowable jacking capacity, the required fabrication tolerances to prevent damage to the pipe during installation, and provide a certification from manufacturer indicating that the pipe meets these tolerances and is designed to meet all anticipated loading conditions with an adequate factor of safety for designed operation period of tunnel/project.

1.5.3.7 Ground Stabilisation: Submit plan for controlling the loss of ground into the shafts at all times, including the periods during launch and retrieval of the pipe jacking shield, i.e., when exiting the launch shaft and entering the reception shaft. Provide details and dimensioned drawings on the entry and exit shaft seals and the mounting procedures.

1.5.3.8 Safety Plan: A Safety Plan for the pipe jacking operations including air monitoring equipment and procedures and provisions for lighting, ventilation, and electrical system safeguards. Provide name of site safety representative responsible for implementing safety program.

1.5.3.9 Contingency Plans: The following list includes problem scenarios that may be encountered during the pipe jacking operations. The Contractor shall submit contingency plans for dealing with each problem scenario while satisfying the specifications. These plans shall include the observations, communications with client/designer and measurements required to clearly identify the cause of the problems and remedial work.

1.5.3.9.1 TBM or shield unable to advance:

(a) Possible obstructions (including boulders, old foundations, well casings, metallic debris, or reinforced concrete).

(b) Insufficient jacking capacity.

(c) TBM or shield malfunction.

(d) Spoil Removal Problems: Spoils becoming clogged on conveyor/auger system.

(e) Noticeable hydrocarbon smell is detected in the TBM, shield, tunnel, or shaft.

(f) Laser distorted by heat, humidity, or physical disturbance. Resetting and survey verification of the laser and associated fixtures is required prior to commencing jacking of the next pipe segment.

1.5.3.9.2 Jacking Forces:

(a) Jacking forces increase dramatically or suddenly.

(b) Jacking forces reach design capacity of pipe, jacking frame, or thrust wall (treat these scenarios as separate incidents).

1.5.3.9.3 Face instability when advancing the tunnel.

(a) Running or flowing ground is encountered resulting in excess lost ground.

(b) Groundwater inflows develop resulting in lost ground or in a manner that otherwise hinders progress.

1.5.3.9.4 Settlement and Subsidence:

(a) Survey measurements indicate deformations exceed allowable limits as indicated in Section 02445, Instrumentation and Monitoring.

(b) Excavated volumes significantly exceed pipe volume installed.

(c) Voids are encountered or created by over excavation that may not be detectable by survey measurements.

1.5.3.9.5 Steering difficulties result in line and grade tolerances being exceeded.

1.5.3.9.6 Pipe has been damaged or has been found to be out of compliance with specifications:

(a) Before installation.

(b) During, or after installation.

1.5.3.9.7 Thrust block or frame or other thrust reaction element deforms excessively under jacking loads, or provides insufficient capacity to advance pipe.

1.5.3.9.8 Severe storms or flooding predicted; shaft flooding possible.

1.5.3.9.9 Pre-construction survey of existing conditions, including videotape and still photographs documenting conditions of existing gutters, sidewalks, driveways, and other structures or improvements.

1.5.4 Record Submittals:

1.5.4.1 Daily Records: The following daily records shall be submitted to the onsite Engineer for review, by noon on the next working day following the shift for which the data or records were taken:

1.5.4.1.1 Jacking Records: The Contractor shall provide complete written jacking records to the Contract Administrator. These records shall include for each pipe, at a minimum: date, time, name of operator, tunnel drive identification, installed pipe number and corresponding tunnel length, time required and height of spoil per car to jack each pipe, time required to set subsequent pipe, spoil volumes (muck cars per pipe joint), soil conditions including occurrences of unstable soils and estimated groundwater inflow rates if any, jacking forces, steering jack positions, line and grade offsets, any movement of the guidance system, shield roll, intermediate jacking station use and jacking forces, volume and location of lubricant pumped, problems encountered with the pipe jacking shield or other components or equipment, and durations and reasons for delays. Manually recorded observations should be made at intervals of not less than four times per pipe, whenever conditions change, and as directed by the Contract Administrator. At least seven (7) days prior to the launch of the shield, the Contractor shall submit template of the jacking logs and daily/shift reports or records to be used.

1.5.4.1.2 Survey Measurements: Survey measurements of pipe alignment and settlement points shall be submitted to the Contract Administrator within 24 hours of the measurements. Measurements shall be made in accordance with provisions and schedules in Section 02445, Instrumentation and Monitoring, or more frequently if directed by the Contract Administrator.

1.6 Project/Site Conditions

1.6.1 For geotechnical information refer to "Geological Hazards and Geotechnical Investigation Persigo Wastewater Treatment Plant Outfall Grand Junction, Colorado, Project # 01543-0001 dated October 10, 2017.

1.6.2 Site Specific Data:

1.6.2.1 Test Pit TP-1 as reported in the Geological Hazards and Geotechnical Investigation Persigo Wastewater Treatment Plant Outfall was dug in September of 2017 to a depth of 13 feet in the center median of I-70. Material in TP-1 was Gravelly Clay with Cobbles to Clayey Sand with Gravel for the first 5 feet with Sandy Gravel and Cobbles below 5 feet. Cobble sizes of up to 12 inches were observed. The material exhibited characteristics of flowing, non-cohesive, non-plastic soils in accordance with the Tunnelmans Ground Classification. Groundwater was observed at a depth of 9 feet. Surface elevation is approximately 4514 above mean sea level.

1.6.2.2 Test Pit TP-2 as reported in the Geological Hazards and Geotechnical Investigation Persigo Wastewater Treatment Plant Outfall was dug in September of 2017 to a depth of 10 feet approximately 20 feet north of westbound of I-70 at a location approximately equal to the receiving shaft. Material in TP-2 was Clayey Sand with organics for the first 2 feet where it transitioned to Clayey Sand with gravel to a depth of 7 feet. Below that elevation was observed to be Sandy Gravel and Cobbles. Cobble sizes of up to 12 inches were observed. The material exhibited characteristics of flowing, non-cohesive, non-plastic soils in accordance with the Tunnelmans Ground Classification. Groundwater was observed at a depth of 8 feet. Surface elevation is approximately 4514 above mean sea level.

1.6.3 For baseline purposes, the anticipated ground conditions along the trenchless alignment indicated on the Contract Drawings are baselined as the following:

1.6.3.1 Soils at the proposed horizon of the trenchless alignment will consist of flowing to running ground, non-cohesive sandy gravel and cobbles (GP)

1.6.3.2 Full face of non-cohesive materials that will fast ravel and flow when not adequately supported at the face.

1.6.3.3 Granular materials will be encountered during the launching, receiving and tunnel excavation. Direct communication with the Colorado River and nearby tributaries will exhibit flowing behavior when not adequately supported or dewatered

1.6.3.4 The relative percentage of non-cohesive materials such a sand, gravel and cobbles will be more than 95% within the tunnel zone.

1.6.3.5 Cobbles, as defined ASTM D2487 – USCS, are the coarsest material to be encountered during excavation along the alignment shown on the Contract Drawings. Nested cobbles are expected along the tunnel alignment.

1.6.3.6 Non-cohesive materials will cause excessive abrasion and wear to the tooling used for excavation.

1.6.3.7 Approximately 5% or less fines are to be encountered along the within the tunnel zone.

1.6.3.8 The upper five (5.0) feet of ground cover shall be assumed to be artificial fill material. Asphalt and aggregate are anticipated under the Interstate 70. A maximum of 30% of the bank volume of the excavated fill material will contain cobble-sized material.

1.6.3.9 As stated in the Geotechnical Exploration Report, groundwater level varies along this alignment. The groundwater is influenced by the water surface in the Colorado River and may be higher or lower during construction.

1.6.3.10 For design purposes, groundwater levels will be at Elevation 4510 feet prior to be dewatering to allow for potential raised elevations.

1.6.4 Engineered fill of unknown character, material, and engineering properties, may be present beneath the I-70 embankment to an unknown depth. For design purposes, soils at launch and reception shaft and within the proposed trenchless horizon, will be native. The optional intermediate shaft will contain approximately 5 to 8 feet of artificial fill.

1.7 Quality Control

1.7.1 All open-shield pipes jacking work shall be performed by an experienced contractor who meets the qualification requirements of this specification. Failure to meet the qualification requirements is failure to fulfil the Contract and the Contractor will be required to obtain a subcontractor that meets the qualification requirements.

1.7.2 All open-shield pipe jacking work shall be performed by an experienced contractor who has at least six (6) years of experience in performing open-shield pipe jacking work and has completed at least three (3) similar projects involving at least 250 LF of open-shield pipe jacking on each project. At least one of the projects shall have an individual drive equal to or greater in length than the longest drive on this project. The contractor shall submit a description of referenced projects including owner's name and contact information, project superintendent, and machine operators. The contractor shall have experience with pipe jacking for pipes greater than 60 inch in diameter.

1.7.3 The project superintendent shall have at least five (5) years of experience supervising open-shield pipe jacking construction. The Contractor shall submit a description of referenced projects including owner's name and contact information, project superintendent, and machine operators.

1.7.4 The open-shield pipe jacking operator(s) shall have technical training in the operation of the proposed open-shield pipe jacking equipment and shall have completed, as a primary operator, at least three (3) similar open-shield pipe jacking projects involving at least 250 LF of open-shield pipe jacking on each project and shall have experience pipe jacking pipe greater than 60 inch in diameter. At least one of the projects shall

have an individual drive equal to or greater in length than the longest drive on this project. The Contractor shall submit a description of referenced projects including owner's name and contact information, project superintendent, and machine operators.

1.7.5 The site safety representative and personnel responsible for air quality monitoring shall be experienced in tunnel construction and shall have current certification by OHSA or applicable safety regulator.

1.7.6 The surveyor responsible for line-and-grade control shall be a licensed Surveyor registered in the Colorado who has prior experience in similar projects.

1.7.7 The Contractor shall provide written notice to the Contract Administrator at least 72 hours in advance of the planned launch of the pipe jacking shield. All work by the Contractor shall be done in the presence of the Contract Administrator unless the Contract Administrator grants prior written approval to perform such work in Contract Administrator's absence. The Contractor shall immediately notify the Contract Administrator, in writing, when any problems are encountered with equipment or materials, or if the Contractor believes the conditions encountered are materially and significantly different from those represented within the Contract Documents.

1.7.8 The Contractor shall allow free access to Contract Administrator at all times and shall furnish necessary assistance and cooperation to aid the Contract Administrator in observations, measurements, data collection, and sample collection, including, but not limited to the following:

1.7.9 The Contract Administrator shall have full access to the pipe jacking shield and jacking system hydraulic pressure gauges, and all other instrumentation prior to, during, and following all pipe jacking operations. Additionally, the Contractor shall allow the Contract Administrator reasonable access to the pipe jacking shield for inspection of the excavation face.

1.7.10 The Contract Administrator shall have full access to spoils removed from the tunnel excavation prior to, during, and following all pipe jacking operations. The Contract Administrator shall be allowed to collect soil samples from tunnel face, the muck buckets or spoil piles a minimum of once per installed pipe section, or every ten (10) feet, whichever is more often, and at any time when changes in soil conditions or obstructions are apparent or suspected.

1.7.11 The Contract Administrator shall have full access to the bentonite lubrication plant prior to, during, and following all jacking operations. This shall include, but not be limited to, full access to visually inspect storage and mixing tanks, lubricant pressures and pumping rates, amount and type of lubricants on site and sampling and testing to determine lubricant properties.

1.7.12 The Contract Administrator to have access to all data logs generated by equipment, daily logs to be submitted for each shift, no later than the next working day.

1.8 Performance Requirements

1.8.1 Pipe Jacking Equipment:

1.8.1.1 The open-faced pipe jacking shield shall be designed to support all ground loads which may be imposed upon it as well as any surcharge loads and loads imposed by the thrust jacks, steering mechanisms, and other appurtenances. The shield or TBM shall be continuous around its full perimeter and shall have suitable breast tables, sand shelves, breast jacks, closable flood doors, or other such provisions to support the excavation face and prevent loss of ground. Non-rotary type shields shall have a hood that covers the crown and projects not less than 24 inch nor more than 36 inch beyond the shield edge. The shield or TBM shall be capable of fully supporting the excavation face, including periods of shutdown or running/flowing ground conditions.

1.8.1.2 The pipe jacking shield or TBM and excavation equipment selected for the project shall be compatible with the geologic conditions described in the Geotechnical Report, Geotechnical Report, and the geologic conditions anticipated by the Contractor. The pipe jacking shield or TBM, including the weight, dimensions, steering capabilities, and other characteristics, shall be suitable for, and capable of, efficiently advancing through the geologic conditions described in the Geotechnical Report and the geologic conditions anticipated by the Contractor. The pipe jacking shield shall be capable of excavating or handling boulders or other hard objects as detailed in section 3.4, Obstructions.

1.8.1.3 The pipe jacking shield shall have an articulation joint between two segments of the shield, with a watertight joint. The shield shall be steerable in both the vertical and horizontal directions to allow the operator to maintain line and grade within the specified tolerances listed in this Section. The shield shall include laser or theodolite guidance checking capability on a continuous basis, and monitored continuously by the operator. The guidance system shall be designed to function at the maximum required drive length without loss of accuracy or reliability of function. If a rotary-type cutterhead is used, the cutterhead shall have a reversible drive system so that it can rotate in either direction or other suitable provisions to minimize rotation or roll of the shield and/or pipe during installation.

1.8.1.4 Prevent material from moving into the tunnel through the joint between the tail skin and the pipe.

1.8.1.5 Maximum allowable radial overcut values shall be selected to minimize potential settlements of the ground and subsurface facilities.

1.8.1.6 The jacking system shall be capable of continuously monitoring and logging the jacking pressure, the rate of advancement, and the distance jacked. The jacking system shall develop a uniform distribution of jacking forces on the end of the pipe.

1.8.1.7 A lubrication injection system shall be provided to inject pipe lubricant around the shield and jacking pipe to decrease frictional resistance. Lubrication ports shall also be used for contact grouting upon completion of the drive.

1.8.1.8 The spoil conveyance system shall be designed for the full range of ground conditions described in the Geotechnical Report and anticipated by the Contractor. The system shall allow determination of muck volumes per pipe jacked in terms of height per muck car or conveyor belt weights, if a conveyor belt system is used.

1.8.2 Methods and equipment used shall control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities, and improvements. Ground movements (settlement/heave) shall be limited to values that shall not cause damage to adjacent utilities and facilities. In no case shall settlements exceed the applicable values listed in Section 02445, Instrumentation and Monitoring.

1.8.3 The thrust block face or other thrust resisting element shall be constructed perpendicular to the proposed pipe alignment. The thrust block or other thrust resisting element shall be designed to withstand the maximum jacking forces developed by the main jacks, without excessive stresses, deflection, or displacement.

1.8.4 Pipe design for jacking loads and acceptable fabrication tolerances is the responsibility of the Contractor. Pipe shall be designed with a minimum factor of safety against the anticipated jacking load as defined in 02315 – Steel Casing Pipe.

1.8.5 The Contractor shall determine required spacing of intermediate jacking stations, based on geotechnical conditions described in the Geotechnical Report, estimated jacking forces, and jacking load capacity of the pipe and jacking frame proposed by the Contractor. An IJS shall be installed and used if anticipated or actual jacking forces exceed 70% of the allowable design capacity of the jacking pipe, jacking frame, thrust block, or thrust capacity of the main jacks, whichever is the lowest. The Contractor is responsible for all IJS that may be required, and pipe specials.

PART 2 NOT USED

PART 3 EXECUTION

3.1 General

3.1.1 Pipe jacking shall not begin until the following tasks have been completed:

3.1.1.1 All required submittals have been provided, reviewed, and accepted.

3.1.1.2 All notices, permits, licenses are obtained and/or given.

3.1.1.3 Required traffic management plan to accommodate site and deliveries have been setup.

3.1.1.4 Receiving shaft excavations and support systems have been completed for the planned drive in accordance with accepted submittals and the requirements of this Section and Section 02621, Shaft Construction.

3.1.1.5 The Contractor has pre-grouted the soils at all entry and exit locations for the planned drive and behind thrust blocks or elements where necessary and as approved by the Contract Administrator to stabilise weak, running or flowing soils. The Contractor has confirmed that the ground has been improved to the extent that ground will remain stable without movement of soil or water while the entry/exit location shoring is removed and while the machine is being launched or received into a shaft or during jacking operations. The progressive steps identified below shall be used to confirm suitable ground improvements for all shaft types and entry/exit locations:

3.1.1.5.1 After the Contractor believes that he has improved the ground sufficiently outside a given shaft seal, the Contractor shall demonstrate the suitability of the improvements by cutting a 2 inch diameter hole in the shoring wall near the centre of the bore. If no obvious soil and less than 3 gpm of water enters the shaft, the Contractor may progress to the next demonstration step. If any soil or greater than 3 gpm of water enters the shaft, the Contractor shall seal the demonstration hole and further improve the ground before repeating the demonstration step.

3.1.1.5.2 After successful completion of the first demonstration step, the Contractor shall demonstrate the suitability of the ground improvements by cutting a 12 inch diameter hole in the shoring wall at the location of previous demonstration hole. If no soil and less than 3 gpm of water enters, the Contractor may progress to the next demonstration step. If any soil or greater than 3 gpm of water enters the shaft, the Contractor shall seal the demonstration hole and further improve the ground before repeating the demonstration step.

3.1.1.5.3 After successful completion of the first two demonstration steps, and if the Contractor believes the ground improvements are sufficient, the Contractor may proceed with remainder of the shaft wall penetration procedures.

3.1.1.6 The location, orientation and grade of the jacking frame or guide rails and entry/exit seals for the planned drive have been surveyed to ensure they are on the proper line and grade and to verify that they are properly supported. Special care shall be taken when setting the guide rails and jacking frame/elements to ensure stability and correctness of the alignment and grade. Guide rails or jacking frame/elements shall be securely attached to the shaft supports or concrete working slab, with supplementary braces, piles, concrete, or grout if necessary, to prevent movement or shifting during the work. Guidance system shall be calibrated and verified to start operation with required accuracy.

3.1.1.7 A start-up inspection of all mechanical and hydraulic systems associated with the pipe jacking operations has been completed. The system shall be tested to ensure that the pipe jacking shield and supporting equipment is functioning properly. The Contract Administrator shall be notified at least 72 hours prior to the start-up inspection and a site inspector representing The Contract Administrator shall be present during the start-up inspection. Key shield performance data shall be measured and recorded by the Contractor during this inspection, including cutterhead rotational torque (if a rotating cutterhead is used, including zero load torque), correct functioning of main and steering jacks, laser, and other components. The records of the start-up inspection shall be submitted to the Contract Administrator within 24 hours of the completed inspection.

3.1.1.8 Site safety representative has prepared a code of safe practices and an emergency plan in accordance with OHSA and other applicable requirements. Provide the Contract Administrator with a copy of each prior to starting pipe jacking. Hold safety meetings and provide safety instruction for new employees as required by OHSA. Conduct a pre-construction safety conference in accordance with OHSA requirements. Arrange this conference and inform the Contract Administrator of the time and place of the conference at least seven (7) days in advance.

3.1.1.9 All specified geotechnical and environmental instrumentation and monitoring required for the planned drive has been installed, approved, and baselined.

3.1.1.10 Pre-construction survey and documentation of existing conditions, i.e., driveways, sidewalks, curb and gutter, structures, etc. has been completed and transmitted to the Contract Administrator.

3.1.2 The Contractor shall furnish all necessary equipment, power, water, and utilities for pipe jacking, pipe lubricant mixing and pumping, spoil removal and disposal, grouting, and other associated work required for the Contractor's methods of construction.

3.1.3 Conduct all operations such that trucks and other vehicles do not interfere with traffic or create a mud, dust, or noise nuisance in the streets and to adjacent properties. Promptly clean up, remove, and dispose of mud or spoil spillage.

3.1.4 All work shall be done so as not to disturb roadways, adjacent structures, landscaped areas, or existing utilities. Any damage shall be immediately repaired to original or better condition and to the satisfaction of The Contract Administrator, at no additional cost to The City.

3.1.5 Whenever there is a condition that is likely to endanger the stability of the excavation or adjacent structures, the Contractor shall operate with a full crew 24 hours a day, including weekends and holidays, without interruption, until those conditions no longer jeopardize the stability of the work.

3.2 Pipe Jacking

3.2.1 Pipe jacking shall be completed in accordance with the accepted submittals, and all applicable permit conditions.

3.2.2 Provide a suitable jacking frame and thrust block or elements to carry out the work. Provide intermediate jacking stations (IJS) as required to complete the pipe jacking drives indicated on the Plans.

3.2.3 Transport the jacking pipe from storage to jacking shaft without damage. Transport methods shall be acceptable to pipe manufacturer. QA/QC inspection shall be performed by the Contractor and The City and observations to be recorded as soon as pipes are delivered on site and before lowering them down into the shaft. Damaged jacking pipe shall not be used in the work. When lowered, immediately set the pipe to be jacked on properly braced and supported guide rails or jacking frame. Unacceptable pipe as determined during this inspection or through any other inspection shall be removed from the site, properly disposed of, and replaced with acceptable pipe meeting specified requirements at no additional cost to The City. A repair procedure may be acceptable at the sole discretion of the Contract Administrator as indicated in Paragraph 3.2.5 below.

3.2.4 The axial forces from the thrust jacks shall be distributed to the jacking pipe uniformly through a properly designed thrust ring and cushion material to prevent damage to the ends of the pipe. The Contractor or pipe manufacturer shall install pipe cushion materials between each jacking pipe joint. The cushion materials or compression rings shall be made of plywood or other materials recommended by the pipe manufacturer and reviewed by the Contract Administrator. The compression rings shall not protrude beyond the inner or outer diameter of the pipe. The compression rings shall be of sufficient thickness and stiffness to distribute the jacking load between successive pipe sections, and minimize eccentric loading.

3.2.5 Jacking pipe sections shall be jacked into position following the design line and grade without damaging the pipe. In the event a section of pipe is damaged during the jacking operation, the Contractor, with approval from the Contract Administrator, shall make temporary repairs to the pipe and shall jack the pipe through to the next shaft for removal. Other methods of repairing the damaged pipe may be proposed in a submittal for review by the Contract Administrator, who shall have sole discretion in determining acceptability of the submittal and acceptance of any repairs.

3.2.6 The pipe jacking shield shall be operated to restrict the excavation of the materials to a volume equal to the shield and pipe jacked, to prevent loss of ground and settlement or possible damage to overlying structures. The Contractor shall monitor, measure, and report excavated spoil volume. If excavated spoil volume with proper bulking factors exceeds the theoretical volume of the shield and pipe being installed (by 10%), the Contractor shall notify the Contract Administrator and promptly modify excavation and face support procedures to prevent further over excavation.

3.2.7 Pipe jacking operations shall control surface settlement and heave above the pipeline to prevent damage to existing utilities, facilities, and improvements. The Contractor shall repair any damage resulting from construction activities, at no additional cost to The City and without extension of schedule for completion. The Contractor shall pressure grout any voids caused by or encountered during the shaft construction or

pipe jacking including the annular space created by the radial overcut of the shield (as specified in Section 03360, Contact Grouting). The Contractor shall modify equipment and procedures as required to avoid recurrence of excessive settlements or damage.

3.2.8 Provide a lubrication system, and inject pipe lubricants through injection ports at the rear of the pipe jacking shield and ports in the jacking pipe as necessary, to minimize pipe friction. Injection ports shall be installed by the manufacturer in the pipe at intervals not to exceed 10 LF along the pipe string. Pipe lubricants shall be injected continuously as the pipe is advanced. The volume injected shall not be less than that required to fill the annular void space outside the pipe. Inject greater volumes as required to minimize jacking forces.

3.2.9 Unless ground improvement/modification has been conducted in order to prevent settlement, excavate continuously 7 days per week and 24 hours per day when excavating tunnel within 10m in plan from any adjacent structures. The Contractor shall insure sufficient muck storage capacity is available on site prior to commencing tunnelling in proximity to a structure during muck hauling restrictions.

3.2.10 Completely contain, transport, and properly dispose of all excavated materials away from the construction site. Use only the disposal sites identified in approved submittals for spoil disposal.

3.2.11 Contact Grouting: Within 24 hours after pipe jacking is complete or sooner depending on ground conditions, fill the annular space created by the overcut of the shield with contact grout in accordance with Section 02455, Contact Grouting.

3.2.12 Probing and Exploratory Drilling

3.2.12.1 Probe holes ahead of the excavation face with a minimum diameter of 3 inch shall use rotary drilling techniques and are intended to confirm the geological conditions to be encountered by the excavation and to detect groundwater, sand lenses, zones of wet silt and other potentially unstable soils. The probe holes shall be located as determined by the Contractor or as approved by The City, but at a minimum, probing shall be continuous in at least two holes spaced in face. Probe holes shall be logged by a qualified geologist or geotechnical engineer engaged by the Contractor.

3.2.12.2 Where a probe hole indicates water inflow, apply further investigation by drilling an additional probe hole approximately 24 inch below the water bearing probe hole. Repeat this procedure until the water bearing strata has been dewatered sufficiently to maintain stability and safely proceed with the work.

3.2.12.3 Overlap probe holes in longitudinal direction by at least 10 feet.

3.2.12.4 The City shall be notified in advance of all probe and exploratory drilling.

3.2.12.5 Interpret cores and discharge of probe holes with regard to soil behaviour during excavation ahead of the tunnel heading.

3.3 Control of Line and Grade

3.3.1 The City will establish the benchmarks on the ground surface as indicated on the Plans. The Contractor shall verify these benchmarks by survey prior to the start of construction, and shall confirm positions or report any errors or discrepancies in writing to the Contract Administrator.

3.3.2 After confirming that all established benchmarks provided for the Contractor's use are accurate, use these benchmarks to furnish and maintain all reference lines and grades for pipe jacking. The Contractor shall use these lines and grades to establish the exact location of the jacking pipe using a laser or theodolite guidance system. Submit to the Contract Administrator copies of field notes used to establish all lines and grades and allow the Contract Administrator to check guidance system setup prior to beginning each pipe jacking drive. Provide access for the Contract Administrator to perform survey checks of the guidance system and the line and grade of the jacking pipe on a daily basis during pipe jacking operations. The Contractor shall be fully responsible for the accuracy of the work and the correction of it, as required.

3.3.3 The jacking pipe shall be installed in accordance with the following tolerances:

3.3.3.1 Variations from Design Line (Horizontal): 3 inch maximum.

3.3.3.2 Variations from Design Grade (Vertical): 6 inch maximum.

3.3.4 The shield or TBM shall be steered to maintain line and grade within the tolerances specified. This shall be achieved by continuously monitoring and adjusting line, grade, roll, and steering attitude during the operation. If the installation deviates from line or grade, make the necessary corrections, and return to the design alignment and grade at a rate of not more than 1 inch per 25 feet.

3.3.5 The guidance system shall be mounted independently from the thrust block and jacking frame to maintain alignment if there is movement of equipment during jacking. Stop pipe jacking operations and reset guidance system if its alignment shifts or is moved off design alignment and grade for any reason. Check guidance system setup and position of all intermediate lasers and mounting brackets at least once per shift. Guidance system should only be reset by experienced, competent surveying personnel in accordance with acceptable procedures.

3.3.6 Monitor line and grade continuously during pipe jacking operations. Record deviation with respect to design line and grade at least twice per pipe joint at approximately equally spaced intervals and submit records to Contract Administrator as requested.

3.3.7 If the pipe installation does not meet the specified tolerance, the Contractor shall correct the installation including any necessary redesign of the pipeline or structures and acquisition of necessary easements. All corrective work shall be performed by the Contractor at no additional cost to The City and without schedule extension, and is subject to the written approval of the Contract Administrator.

3.4 Obstructions

3.4.1 If the pipe jacking operations should encounter an object or condition that prevents the forward progress of the shield, the Contractor shall notify the Contract Administrator immediately. The Contractor shall correct the condition, and remove, clear, or otherwise make it possible for the pipe jacking shield and jacked pipe to advance past any objects or obstructions that impede forward progress of the shield. Upon written notification by the Contract Administrator, the Contractor shall immediately proceed with removal of the object by approved methods, as submitted by the Contractor in approved submittals.

3.4.2 The Contractor will receive compensation for removal of non-boulder obstructions, defined as metallic debris, reinforced concrete, whole trees, and other hard objects larger than 30% of the outer diameter of the shield, which cannot be broken up by the cutting tools or manually removed through open portions of the face of the shield with diligent effort, that are partially or wholly within the cross-sectional area of the bore. The Contractor must demonstrate that the non-boulder obstruction stopped or significantly impeded forward progress of the tunnel excavation for the object to qualify as an obstruction. Payment will be negotiated with the Contractor by The City on a case-by-case basis. However, any removal process that does not allow direct inspection of the nature and position of the obstruction will not be considered for payment.

3.4.3 The Contractor will receive no additional compensation for splitting, excavating, removing, clearing, or otherwise making it possible for the shield to advance past objects consisting of metallic debris, wood, unreinforced concrete, and other non-metallic objects or debris with maximum lateral dimensions less than 30% of the maximum outer diameter of the shield.

3.4.4 Boulder obstructions are defined as a boulder encountered at the heading of the tunnel, with a diameter greater than 30% of the excavated tunnel diameter, that stops or significantly inhibits forward progress of the tunnelling shield. For payment of boulder obstructions encountered during pipe jacking, refer to specification 01025, Measurement and Payment.

3.5 Safety

3.5.1 The Contractor is responsible for safety on the job site. Methods of construction shall be such as to ensure the safety of the work, Contractor's and other employees on site, and the public. Perform all work in accordance with all current applicable regulations and safety requirements of Federal, State, and local agencies. In the event of conflict, comply with the more stringent requirements.

3.5.2 When personnel are underground, furnish and operate a temporary ventilation system, and air and dust monitoring systems including continuous monitoring of hazardous, toxic, flammable, or explosive gases conforming to the requirements of OHSA. Operate and maintain a ventilation system that provides a sufficient supply of fresh air and maintains an atmosphere free of hazardous, toxic, or flammable gasses in all underground work areas.

3.5.3 All work shall conform to the requirements of OHSA. Gas testing shall be performed by a certified gas tester in accordance with OHSA requirements.

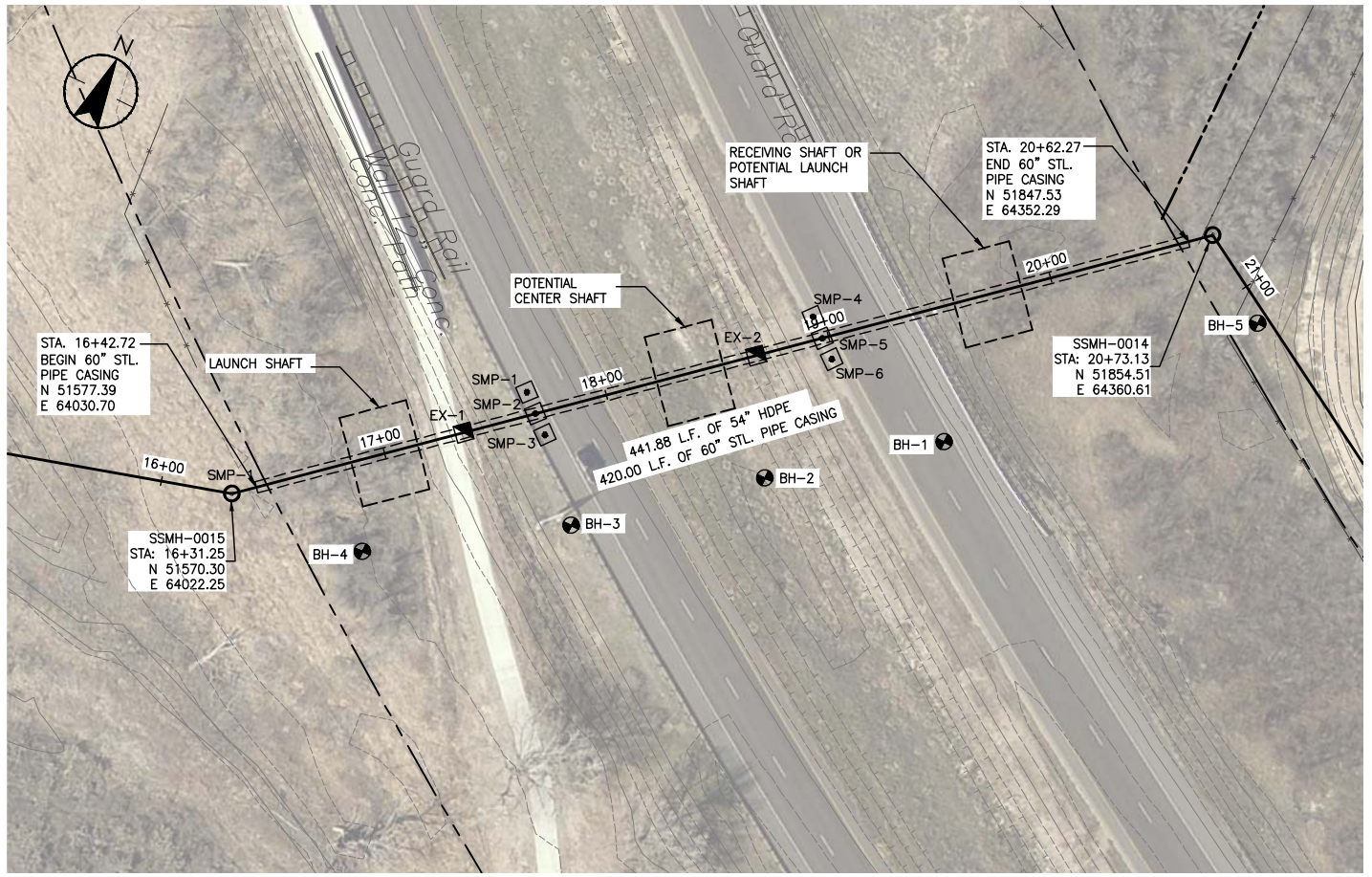
3.5.4 No gasoline-powered equipment shall be permitted in jacking and receiving shafts or tunnel at any time. Diesel, electrical, hydraulic, and air powered equipment is acceptable, subject to applicable local, State, and Federal regulations.

3.6 CLEANUP AND RESTORATION

3.6.1 After completion of pipe jacking, all construction debris, spoils, oil, grease, and other materials shall be removed from the jacking pipe, jacking and receiving shafts, and all Contractor work areas. Cleaning shall be incidental to the construction. No separate payment shall be made for cleanup.

3.6.2 Restoration shall follow construction as the work progresses, and shall be completed as soon as possible. Restore and repair any damage resulting from surface settlement caused by shaft excavation, or pipe jacking. Any property damaged or destroyed, shall be restored to a condition equal to or better than existing prior to construction. Restoration shall be completed no later than thirty (30) days after the pipe jacking is complete. This provision for restoration shall include all property affected by the construction operations. Restoration shall be incidental to the construction. No separate payment shall be made for restoration.

END OF SECTION



MONITORING PLAN

0 40' 80'

SCALE IN FEET

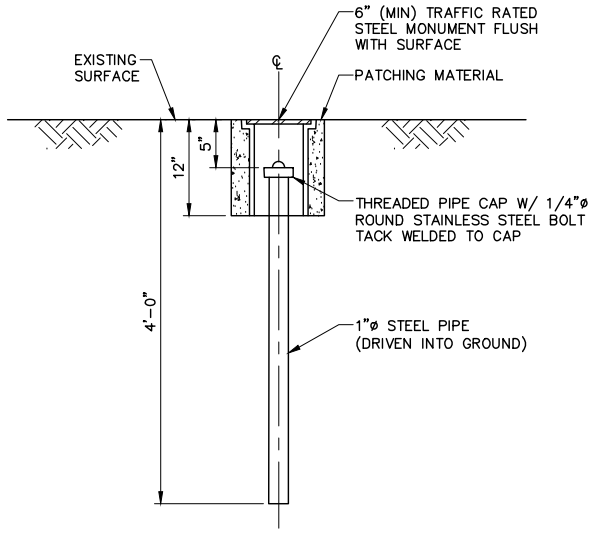
INSTRUMENTATION LEGEND

- EXTENSOMETER (EX)
- SETTLEMENT MONITORING POINT (SMP)
- GEOTECHNICAL BORING (BH)

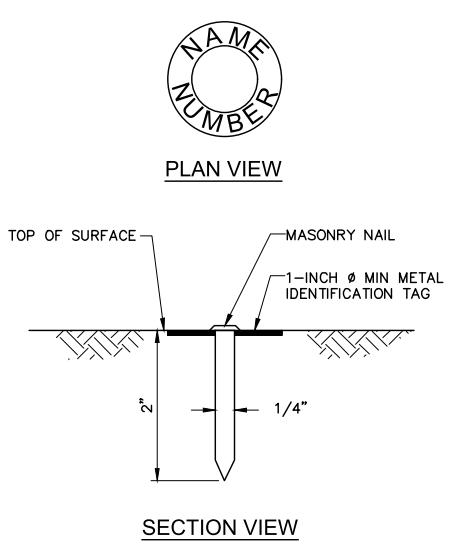
NOTES:

1. LOCATIONS OF THE SETTLEMENT MONITORING POINTS MAY REQUIRED ADJUSTMENT IN THE FIELD WITH APPROVAL OF THE ENGINEER.
2. SETTLEMENT MONITORING POINTS NEAR THE SHAFTS SHALL BE LOCATED A MINIMUM OF 5' FROM THE SHAFT EXCAVATION POINTS AND SUPPORT SYSTEM.
3. CONTRACTOR'S OPERATIONS RELATING TO WORK WITHIN CDOT ROW SHALL CONFORM WITH THE CONDITIONS ENUMERATED IN THE CDOT ENCROACHMENT PERMIT TO BE ISSUED TO THE CONTRACTOR.

DESIGNATION	TYPE	NORTHING	EASTING
SMP-1	SETTLEMENT MONITORING POINT	51665.13	64119.60
SMP-2	SETTLEMENT MONITORING POINT	51658.22	64126.93
SMP-3	SETTLEMENT MONITORING POINT	51651.64	64134.64
SMP-4	SETTLEMENT MONITORING POINT	51748.05	64218.31
SMP-5	SETTLEMENT MONITORING POINT	51741.27	64225.95
SMP-6	SETTLEMENT MONITORING POINT	51734.78	64233.61
EX-1	EXTENSOMETER	51637.45	64102.19
EX-2	EXTENSOMETER	51721.91	64203.38



1 DETAIL
EXTENSOMETER (EX)



2 DETAIL
SETTLEMENT MONITORING POINT (SMP)

Stantec
2000 South Colorado Boulevard Suite 2-300
Denver, CO U.S.A.
www.stantec.com

No.	Revision	By	Appd.	YY.MM.DD
	Issued			

Client/Project
CITY OF GRAND JUNCTION / MESA COUNTY
PERSIGO WASTEWATER TREATMENT PLANT
DIFFUSER OUTFALL IMPROVEMENTS

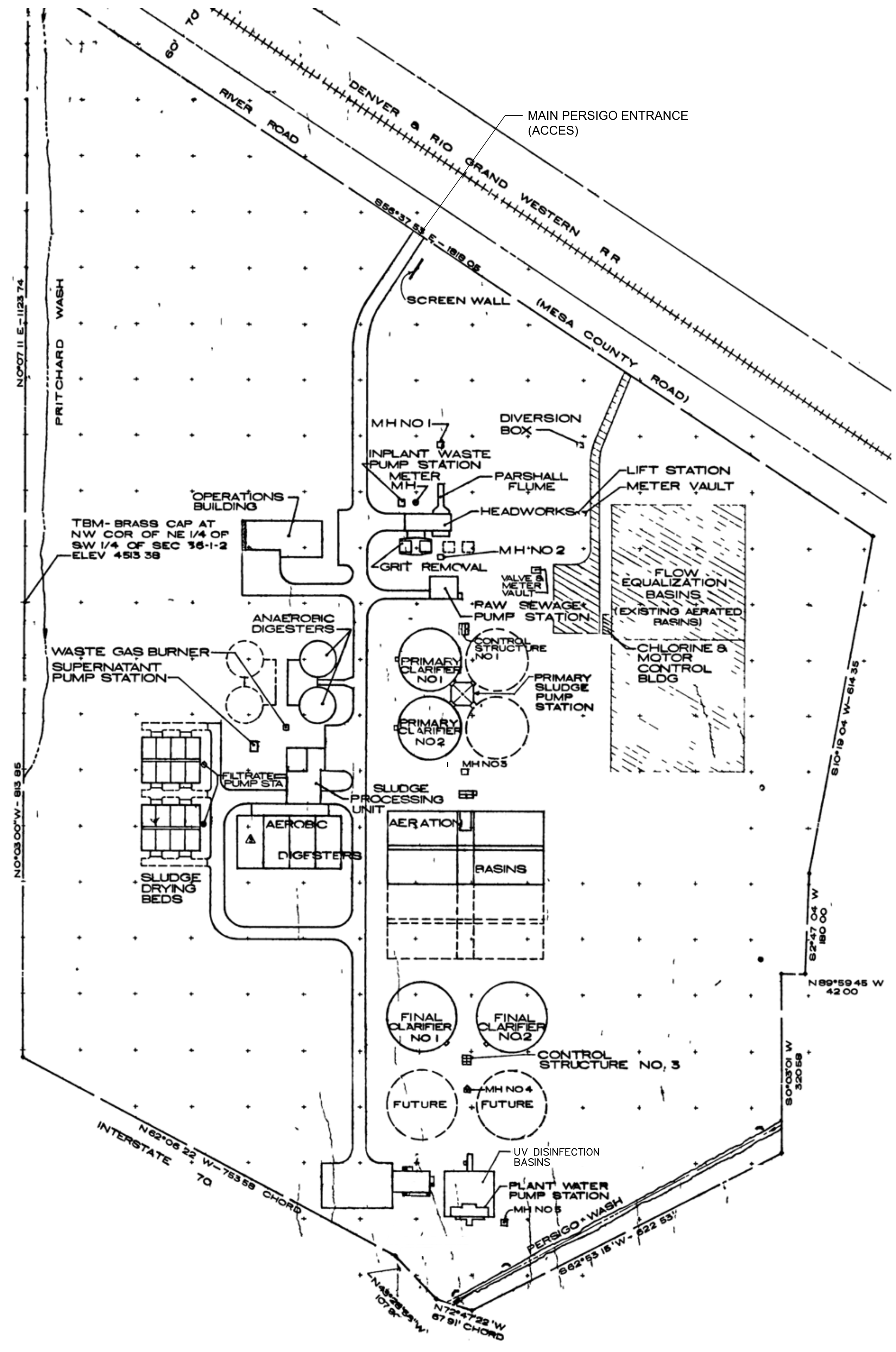
Title
OUTFALL PIPELINE MONITORING PLAN

Permit-Seal

Project Number: 205305055
File Name: 05055-C105.dwg

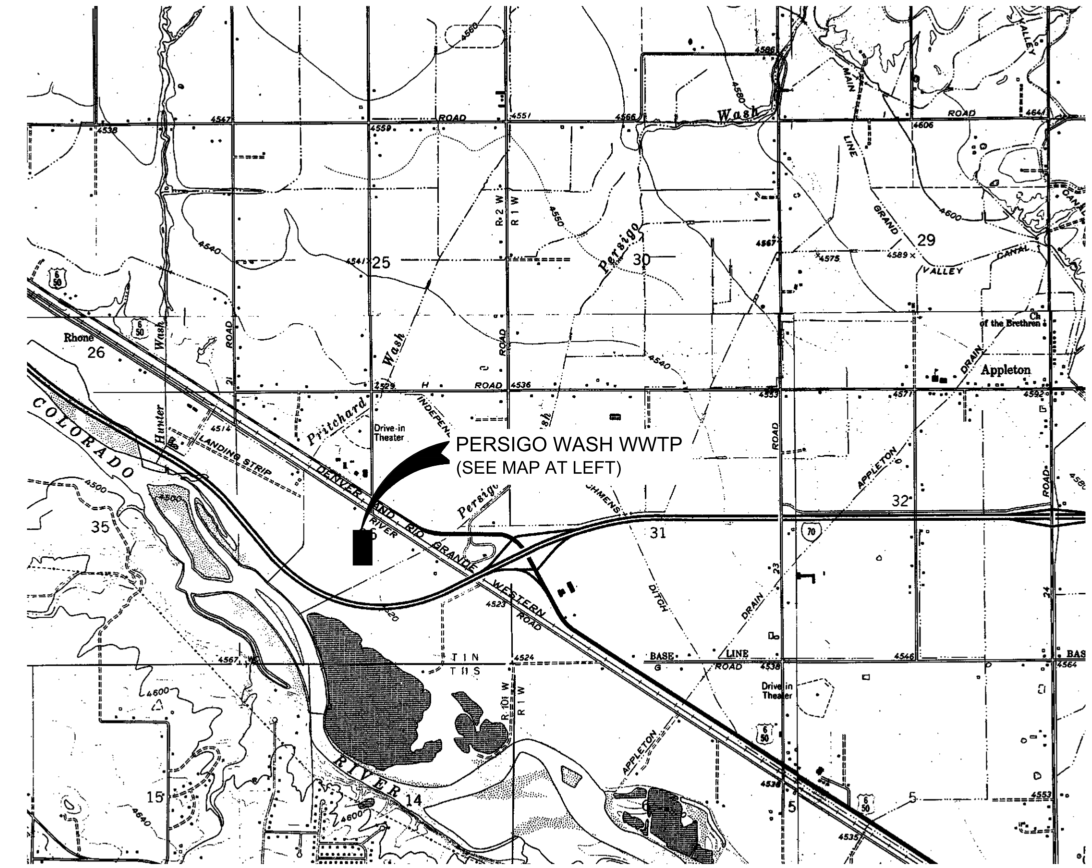
S.L.H.	D.S.	C.R.H.	18.05.10
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. C105
Revision Sheet
18 of 18



PERSIGO WASH WASTEWATER TREATMENT PLANT SITE PLAN

N.T.S.



PROJECT LOCATION MAP

N.T.S.

DRAWING INDEX

REVISION/ ISSUE	SHEET NUMBER	DRAWING NUMBER	DRAWING TITLE
			GENERAL
	1	G001	COVER SHEET
	2	G002	PROJECT LOCATION MAP, GENERAL NOTES, AND LIST OF DRAWINGS
	3	G003	DRAWING ABBREVIATIONS LEGENDS AND SYMBOLS
	4	G100	PROJECT EASEMENT PLAN
			CIVIL
	5	C100	OVERALL SITE PLAN AND PROJECT CONTROL MAP
	6	C101	EROSION CONTROL PLAN
	7	C102	EROSION CONTROL NOTES SHEET 1 OF 3
	8	C103	EROSION CONTROL NOTES SHEET 2 OF 3
	9	C104	EROSION CONTROL NOTES SHEET 3 OF 3
	10	C200	OUTFALL PIPELINE PLAN AND PROFILE STA. 10+00.00 TO 20+83.66
	11	C201	OUTFALL PIPELINE PLAN AND PROFILE STA. 20+83.66 TO 30+00.00
	12	C300	PIPELINE SECTIONS
	13	C500	DIFFUSER DETAILS
	14	C501	DETAILS
	15	C502	PIPE AND MANHOLE DETAILS
	16	C503	EROSION CONTROL DETAILS
			STRUCTURAL
	17	S100	EXISTING EFFLUENT BOX STRUCTURAL PLAN, SECTIONS AND DETAILS
	18	C105	OUTFALL PIPELINE MONITORING PLAN

CONTACT INFORMATION

DESIGN ENGINEER
COLIN HAGGERTY, P.E.
STANTEC
2000 S. COLORADO BLVD. SUITE 2-300
DENVER CO, 80222
(303) 285-4594

OWNER
LEE COPPER, P.E.
CITY OF GRAND JUNCTION
250 N 5TH STREET
GRAND JUNCTION CO, 81501
(970) 256-4155

US FISH & WILDLIFE SERVICE
BARB OSMUNDSON, BIOLOGIST
445 WEST GUNNISON AVE., SUITE 240
GRAND JUNCTION CO, 81501
(970) 628-7189

CDOT
JOEL BERSCHAUER
UTILITY AND SPECIAL USE PERMIT COORDINATOR
222 SOUTH 6TH STREET ROOM 100
GRAND JUNCTION CO, 81501
(970) 683-6288

GENERAL NOTES:

1. THE CONTRACTOR SHALL NOTIFY THE CITY OF GRAND JUNCTION AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND VERIFYING ALL EXISTING UTILITIES THAT WILL BE AFFECTED PRIOR TO THE START OF CONSTRUCTION. ANY DISCREPANCIES SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER.
3. ELEVATIONS, DIMENSIONS FOR THE EXISTING PIPING SHOWN ON THE DRAWINGS ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED IN THE FIELD BY THE CONTRACTOR.
4. THE CONTRACTOR SHALL OBTAIN, AT HIS EXPENSE, ALL PERMITS WHICH ARE NECESSARY TO PERFORM THE PROPOSED WORK.
5. EXISTING WASTEWATER TREATMENT SYSTEM SHALL REMAIN ACTIVE FOR THE DURATION OF THE PROJECT. COORDINATE WITH THE OWNER IF INTERFERENCE OR INTERRUPTION WITH THE EXISTING WASTEWATER TREATMENT SYSTEM IS NEEDED FOR CONSTRUCTION.
6. SITE ACCESS ON THE PLANT SIDE SHALL BE FROM THE MAIN ENTRANCE VIA THE MAIN ACCESS ROAD. ACCESS SOUTH OF I-70 SHALL BE AS SHOWN ON DWG. G100.
7. EFFORTS TO SHOW EXISTING PIPING IN THEIR APPROPRIATE LOCATION HAVE BEEN MADE AND ARE SHOWN HEREIN. CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES.

Stantec
2000 South Colorado Boulevard Suite 2-300
Denver, CO U.S.A.
www.stantec.com

Revision

	By	Appd.	YY.MM.DD
C FINAL BID SET DRAWINGS	SLH	CRH	18.01.03
B FINAL CONSTRUCTION DRAWINGS	SLH	CRH	17.05.03
A DESIGN REVIEW APPLICATION	SLH	CRH	16.08.31

Issued

Client/Project
CITY OF GRAND JUNCTION / MESA COUNTY

PERSIGO WASTEWATER TREATMENT PLANT
DIFFUSER OUTFALL IMPROVEMENTS

Title
PROJECT LOCATION MAP, GENERAL NOTES, AND LIST OF DRAWINGS

Permit-Seal

Project Number: 205305055
File Name: 05055-G002.dwg

S.L.H.	D.S.	C.R.H.	18.01.02
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. G002

Revision C

V:\2053\active\205305055_Design\drawings\Current\general\05055-G002.dwg
2018/05/14 9:29 AM By: Hoover, Stu