



**RESOLUTION NO. 17-FY2018**

**RELATIVE TO CHANGE ORDER NO. 4 FOR THE AGAT SANTA RITA  
WASTEWATER TREATMENT PLANT UPGRADES CONSTRUCTION  
MANAGEMENT CONTRACT**

**WHEREAS**, under 12 G.C.A. § 14105, the Consolidated Commission on Utilities (“CCU”) has plenary authority over financial, contractual and policy matters relative to the Guam Waterworks Authority (“GWA”); and

**WHEREAS**, the Guam Waterworks Authority (“GWA”) is a Guam Public Corporation established and existing under the laws of Guam; and

**WHEREAS**, GWA currently has a number of critical Court Order (“CO”) projects including construction of the new Agat Santa Rita Wastewater Treatment Plant that is necessary for the plant to achieve compliance with the GWA’s NDPES permit, eliminate by-passes at the old Agat wastewater treatment plant, ensure that solids generated by the WWTP are adequately stabilized and dewatered, and to comply with sludge and biosolids requirements 40 C.F.R. Part 503 as stated in Paragraph 11 of the 2011 Court Order; and

**WHEREAS**, GWA executed contracts with Sumitomo Mitsui Construction Company (SMCC) to construct the new WWTP and GHD, Inc. to provide construction management services as a means to work towards achieving the Court Order requirements; and

**WHEREAS**, GWA has executed a few Change Orders to the SMCC contract with the latest one extending the phase II construction completion deadline to March 25, 2018 to address SMCC’s claims related to rain delays; and

//

//

1           **WHEREAS**, via CCU Resolution No. 48-FY2017 executed in July of 2017, the CCU  
2 also authorized the continuation of CM services with GHD. Inc. from August 15, 2017 through  
3 the then anticipated March 31, 2018 construction completion date, after which GWA executed  
4 Change Orders 2 and 3 in the total amount of One Million Fourteen Thousand Four Hundred  
5 Twelve Dollars (\$1,014,412.00); and

6  
7           **WHEREAS**, while SMCC has maintained its staffing levels and construction effort, they  
8 recently submitted an updated project schedule that shows completion of all critical process  
9 facilities by March 2018 and all remaining construction activities by May 2018. SMCC claims  
10 additional delays due to adverse weather and work force shortages as a result of the H2-B visa  
11 program; and

12  
13           **WHEREAS**, GWA management has not agreed to accept this claim and if, after further  
14 investigation, GWA denies the additional delay claims, the current construction contract  
15 completion date of March 25, 2018 will stand; after which Liquidated Damages will be assessed  
16 against the Contractor; and

17  
18           **WHEREAS**, notwithstanding the final disposition of any SMCC claims for an extension  
19 of schedule, construction work will continue until the facility is completed. This means GWA  
20 will still require continuity of construction management services and has therefore requested that  
21 GHD provide a fee proposal for CM services related to the potential extension of the contract  
22 completion date; and

23  
24           **WHEREAS**, the fee proposal submitted by GHD is being evaluated and GWA intends to  
25 negotiate a reasonable not-to-exceed amount to cover the anticipated services needed until  
26 construction completion; and

27  
28           **WHEREAS**, GWA management may also request that GHD, Inc submit a fee proposal  
29 for additional construction management services on the Agat Santa Rita WWTP site related to  
30 the installation of the 21-inch diameter gravity line that ties in the Baza Gardens Pumping and  
31 Conveyance project which is not currently contracted out for installation; and  
32

1           **WHEREAS**, GWA management seeks CCU approval to execute Change Order No. 4  
2 with GHD, Inc. on a Time and Materials basis related to the above described additional work in  
3 an amount not-to-exceed Eight Hundred Eighty-Two Thousand Six Hundred Thirty-One Dollars  
4 (\$882,631.00); and

5  
6           **WHEREAS**, funding for this project will be from the bond funds under the line item -  
7 WW 11-08 "Agat/ Sta Rita STP Replacement" and/or funds derived from the Liquidated  
8 Damages that may be assessed the contractor and will be applied to pay the additional CM  
9 services; and

10  
11           **NOW BE IT THEREFORE RESOLVED**, the Consolidated Commission on Utilities  
12 does hereby approve the following:

- 13           1. The recitals set forth above hereby constitute the findings of the CCU.
- 14           2. The CCU finds that the scope of additional work requested of GHD is  
15 reasonable and necessary.
- 16           3. The CCU finds that the fee proposal submitted by GHD, subject to final  
17 negotiation by GWA Management, to be fair and reasonable, and the terms of  
18 the conditions set by GWA relative to commencement of subsequent work  
19 activities are fair and reasonable and serve as a measure of Quality  
20 Assurance/Quality Control (QA/QC).
- 21           4. The CCU hereby approves GWA management to execute Change Order No. 4  
22 on a Time and Materials basis in an amount not-to-exceed Eight Hundred  
23 Eighty-Two Thousand Six Hundred Thirty-One Dollars (\$882,631.00)  
24 (EXHIBIT A) which would cover CM services through final construction  
25 completion and close-out.
- 26           5. The source of funding for the additional CM services will be from the bond  
27 funds under the line item - WW 11-08 "Agat/ Sta Rita STP Replacement"  
28 and/or funds withheld from the construction contract with SMCC as  
29 Liquidated Damages assessed to the contractor.  
30  
31  
32





# Exhibit A

**Date:** February 16, 2018

**Reference No.:** GHD/GWA – LTR-04

**To:** Mr. John Davis, P.E., Project Manager  
Guam Waterworks Authority  
Gloria B. Nelson Public Utilities Complex  
Route 15, Mangilao, Guam

**Project:** Agat-Santa Rita WWTP Replacement Project - Phase II  
Project No. S14-002-BND

**Subject:** MOD 004, 005, & 006 – Additional Construction Management Services Scope of Work and Fee Proposal

Dear Mr. Davis:

We are pleased to submit this proposal for additional CM support services as described below.

## **SCOPE OF WORK:**

In follow up to our meeting with yourself and Mr. Tom Cruz on February 07, 2018 at the GWA Multi-Purpose Room following our Monthly Managers Meeting, we have prepared three (3) cost proposals to extend our Construction Management Services from April 01, 2018 through June 30, 2018, July 01, 2018 through August 31, 2018, and CM services for the on-site installation of the sanitary sewer line from Baza Gardens. Each has been detailed below.

1. **MOD 04** has been prepared to provide additional CM services from April 01, 2018 to June 30, 2018 per **Table 1**. This modification is needed due to an increase in the overall construction schedule. Additional support services and expenses associated with this effort is detailed below.

- **Item 01: Clearing & Grading QA Testing and Survey Services**

Our original SOW provides concrete testing, material testing, and field verification survey services as a budgetary amount with the understanding that should additional services be needed, they can be brought to GWA's attention for additional compensation.

No budget for these services was allocated in the Clearing and Grading (C&G) phase of work. GHD provided these services using the available Waste Water Treatment Plant Replacement budget with the intent of revisiting the need for additional budget at a later date only if required. The cost to provide compaction testing during the C&G phase was \$6,757.40, concrete testing was \$2,580.60, and survey was \$6,900.00. We request the QA Services budgets be restored by these amounts to allow us to maintain the same level of QA testing and survey for the duration of the project. See attached **Exhibit A**.

- **Item 02: Construction Site Camera**

Our original Contract duration for this project was September 08, 2015 through June 07, 2017. MOD's 01, 02, 03, 04, & 05 extend the Contract Completion date to the end of August 2018. The monthly cost for the site camera fully hosted website is \$325.00 per month. The extension of the contract through August 2018 will require an additional 13 months at a cost of \$4,225.00. Please see attached Work Zone Cam Invoice #ZC0306175169 for the prorated monthly cost. Currently the services are through April 05, 2018 and they will be extended by GHD through June 2018. See attached **Exhibit B**.

- **Item 03: Additional Survey for Hyundai Line Permit Issue**

GHD provided a survey of the centerline of Hyundai Construction Access Road from station 16+51.44 to 24+11.88 to advance the work of the Archaeologist for the permitting of the Hyundai Waterline. Obtaining access for the easement from the Navy and processing of the Building Permit with DPW took in excess of one (1) year. At the time of the survey, DCA's surveyor was not available and the Contractor declined to do the work. GHD took action to advance the work. See attached **Exhibit C**.

2. **MOD 05** has been prepared to provide GWA with advanced notice of anticipated additional CM services that may be required from July 01 to August 31, 2018 per **Table 2**. It is our opinion that the Phase 2 System Priority Work will not ramp down by the end of March 2018 and the project will extend through August of 2018. We base this on field observation and our review of the most recent percent completes provided in the Contractor's updated January 2018 Progress Schedule as follows:

- Process 08 Effluent Pump Station – 45% complete
- Process 10 Aerobic Digester – 64% complete
- Process 11 Dewatering Centrifuge Building – 59%
- Process 13 Plant Water System – 74%
- Process 14 On-site sewer system and collection – 66%
- Process 15 Administrative Building – 45%

We estimate the Phase 2 System Priority Work to be approximately 58% complete in aggregate and this does not include the Equalization Tank which is currently at 5% complete. The contractor's January 2018 progress schedule indicates that Priority Structures will be completed on April 2, 2018 and Non-Priority Structures will be completed on August 10, 2018.

3. **MOD 06** has been prepared to provide additional CM services for the proposed 21-inch Baza Gardens Sanitary Sewer extension from Route 2A to the new ASRWWTP lift station. We have spoken with the Contractor and their current estimated duration for this work is four (4) months per **Table 3**. Our estimate assumes the same duration and also includes the associated QA testing and surveying services. See attached **Exhibit E**.

#### **CLARIFICATIONS AND ASSUMPTIONS:**

1. The CM's staffing shall consist of the following: one (1) Project Manager, one (1) Assistant PM, one (1) Civil/General Inspector, one (1) Special Inspector, one (1) RFI/Submittal Manager, and one (1) Scheduler. The onsite staffing will vary based on the Contractor's level of the work in progress. The CM will coordinate staffing based on the requirements for a particular day or week. No time has been provided for the Principal or any other staff position although they will be participating as needed on the project.

2. Additional budget has been requested for Quality Assurance Compaction Testing, Concrete Strength Testing, Material Testing and Survey Verification for the balance of the work. The execution of MOD 05 assumes the QA services budget requested via MOD 04 have been accepted and approved by GWA. If additional QA services are required it will be brought to GWA's attention and negotiated.
3. The Construction contract will include requirements that the Construction Contractor pay for overtime inspection outside of the normal 40 hour work week and this requirement will be strictly enforced and supported by GWA with payment coming out of the Contractor's Pay Request and then distributed to GHD by GWA or by other acceptable terms to GHD and GWA.
4. GWA agrees to negotiate with GHD for change orders for additional construction phase services due to construction delays, additional work, adverse weather delays, or any other reason not due to the negligent acts of GHD until final acceptance of the project is achieved.

The following tables show the summary of hours and cost for **MOD 04**, **MOD 05**, and **MOD 06** and the totals for all three (3)

**TABLE 1. SUMMARY OF MOD 04 COSTS (April 01, 2018 through June 30, 2018)**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost 04/01/18 to 06/30/18
Project Manager	520	\$100,360	\$4,182	\$104,542
Special Inspector	130	\$28,730	\$1,197	\$29,927
Civil Inspector	520	\$62,920	\$2,622	\$65,542
Assistant PM	520	\$62,920	\$2,622	\$65,542
Special Inspector	520	\$65,520	\$2,730	\$68,250
Submittal/ RFI Manager	520	\$52,520	\$2,189	\$54,709
Scheduler	30	\$4,500	\$188	\$4,688
Expenses				\$32,189
<b>Total</b>	<b>2760</b>	<b>\$377,470</b>	<b>\$15,729</b>	<b>\$425,388</b>

**TABLE 2. SUMMARY OF MOD 05 COSTS (July 01, 2018 through August 31, 2018)**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost 07/01/18 to 08/31/18
Project Manager	360	\$69,480	\$2,895	\$72,375
Special Inspector	90	\$19,890	\$829	\$20,719
Civil Inspector	360	\$43,560	\$1,815	\$45,375
Assistant PM	360	\$43,560	\$1,815	\$45,375
Special Inspector	360	\$45,360	\$1,890	\$47,250
Submittal/ RFI Manager	360	\$36,360	\$1,515	\$37,875
Scheduler	20	\$3,000	\$125	\$3,125
Expenses				\$3,260
<b>Total</b>	<b>1910</b>	<b>\$261,210</b>	<b>\$10,885</b>	<b>\$275,355</b>

- **Item 02: Construction Site Camera**

Our original Contract duration for this project was September 08, 2015 through June 07, 2017. MOD's 01, 02, 03, 04, & 05 extend the Contract Completion date to the end of August 2018. The monthly cost for the site camera fully hosted website is \$325.00 per month. The extension of the contract through August 2018 will require an additional 13 months at a cost of \$4,225.00. Please see attached Work Zone Cam Invoice #ZC0306175169 for the prorated monthly cost. Currently the services are through April 05, 2018 and they will be extended by GHD through June 2018. See attached **Exhibit B**.

- **Item 03: Additional Survey for Hyundai Line Permit Issue**

GHD provided a survey of the centerline of Hyundai Construction Access Road from station 16+51.44 to 24+11.88 to advance the work of the Archaeologist for the permitting of the Hyundai Waterline. Obtaining access for the easement from the Navy and processing of the Building Permit with DPW took in excess of one (1) year. At the time of the survey, DCA's surveyor was not available and the Contractor declined to do the work. GHD took action to advance the work. See attached **Exhibit C**.

2. **MOD 05** has been prepared to provide GWA with advanced notice of anticipated additional CM services that may be required from July 01 to August 31, 2018 per **Table 2**. It is our opinion that the Phase 2 System Priority Work will not ramp down by the end of March 2018 and the project will extend through August of 2018. We base this on field observation and our review of the most recent percent completes provided in the Contractor's updated January 2018 Progress Schedule as follows:

- Process 08 Effluent Pump Station – 45% complete
- Process 10 Aerobic Digester – 64% complete
- Process 11 Dewatering Centrifuge Building – 59%
- Process 13 Plant Water System – 74%
- Process 14 On-site sewer system and collection – 66%
- Process 15 Administrative Building – 45%

We estimate the Phase 2 System Priority Work to be approximately 58% complete in aggregate and this does not include the Equalization Tank which is currently at 5% complete. The contractor's January 2018 progress schedule indicates that Priority Structures will be completed on April 2, 2018 and Non-Priority Structures will be completed on August 10, 2018.

3. **MOD 06** has been prepared to provide additional CM services for the proposed 21-inch Baza Gardens Sanitary Sewer extension from Route 2A to the new ASRWWTP lift station. We have spoken with the Contractor and their current estimated duration for this work is four (4) months per **Table 3**. Our estimate assumes the same duration and also includes the associated QA testing and surveying services. See attached **Exhibit E**.

#### **CLARIFICATIONS AND ASSUMPTIONS:**

1. The CM's staffing shall consist of the following: one (1) Project Manager, one (1) Assistant PM, one (1) Civil/General Inspector, one (1) Special Inspector, one (1) RFI/Submittal Manager, and one (1) Scheduler. The onsite staffing will vary based on the Contractor's level of the work in progress. The CM will coordinate staffing based on the requirements for a particular day or week. No time has been provided for the Principal or any other staff position although they will be participating as needed on the project.



2. Additional budget has been requested for Quality Assurance Compaction Testing, Concrete Strength Testing, Material Testing and Survey Verification for the balance of the work. The execution of MOD 05 assumes the QA services budget requested via MOD 04 have been accepted and approved by GWA. If additional QA services are required it will be brought to GWA's attention and negotiated.
3. The Construction contract will include requirements that the Construction Contractor pay for overtime inspection outside of the normal 40 hour work week and this requirement will be strictly enforced and supported by GWA with payment coming out of the Contractor's Pay Request and then distributed to GHD by GWA or by other acceptable terms to GHD and GWA.
4. GWA agrees to negotiate with GHD for change orders for additional construction phase services due to construction delays, additional work, adverse weather delays, or any other reason not due to the negligent acts of GHD until final acceptance of the project is achieved.

The following tables show the summary of hours and cost for **MOD 04**, **MOD 05**, and **MOD 06** and the totals for all three (3)

**TABLE 1. SUMMARY OF MOD 04 COSTS (April 01, 2018 through June 30, 2018)**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost 04/01/18 to 06/30/18
<b>Project Manager</b>	520	\$100,360	\$4,182	\$104,542
<b>Special Inspector</b>	130	\$28,730	\$1,197	\$29,927
<b>Civil Inspector</b>	520	\$62,920	\$2,622	\$65,542
<b>Assistant PM</b>	520	\$62,920	\$2,622	\$65,542
<b>Special Inspector</b>	520	\$65,520	\$2,730	\$68,250
<b>Submittal/ RFI Manager</b>	520	\$52,520	\$2,189	\$54,709
<b>Scheduler</b>	30	\$4,500	\$188	\$4,688
<b>Expenses</b>				\$32,189
<b>Total</b>	<b>2760</b>	<b>\$377,470</b>	<b>\$15,729</b>	<b>\$425,388</b>

**TABLE 2. SUMMARY OF MOD 05 COSTS (July 01, 2018 through August 31, 2018)**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost 07/01/18 to 08/31/18
<b>Project Manager</b>	360	\$69,480	\$2,895	\$72,375
<b>Special Inspector</b>	90	\$19,890	\$829	\$20,719
<b>Civil Inspector</b>	360	\$43,560	\$1,815	\$45,375
<b>Assistant PM</b>	360	\$43,560	\$1,815	\$45,375
<b>Special Inspector</b>	360	\$45,360	\$1,890	\$47,250
<b>Submittal/ RFI Manager</b>	360	\$36,360	\$1,515	\$37,875
<b>Scheduler</b>	20	\$3,000	\$125	\$3,125
<b>Expenses</b>				\$3,260
<b>Total</b>	<b>1910</b>	<b>\$261,210</b>	<b>\$10,885</b>	<b>\$275,355</b>

**TABLE 3. SUMMARY OF MOD 06 COSTS (Baza Gardens – Four (4) Months)**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost (Four Months)
Project Manager	84	\$15,708	\$655	\$16,363
Civil Inspector	672	\$77,280	\$3,220	\$80,500
Expenses				\$25,026
<b>Total</b>	<b>756</b>	<b>\$92,988</b>	<b>\$3,875</b>	<b>\$121,889</b>

**TABLE 4. SUMMARY OF MOD 04, MOD 05, & MOD 06 TOTAL COSTS**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost MOD 04, 05, & 06
Project Manager	964	\$185,548	\$7,732	\$193,280
Special Inspector	220	\$48,620	\$2,026	\$50,646
Civil Inspector	1552	\$183,760	\$7,657	\$191,417
Assistant PM	880	\$106,480	\$4,437	\$110,917
Special Inspector	880	\$110,880	\$4,620	\$115,500
Submittal/ RFI Manager	880	\$88,880	\$3,704	\$92,584
Scheduler	50	\$7,500	\$313	\$7,813
Expenses				\$60,475
<b>GRAND TOTAL</b>				<b>\$822,631</b>

We look forward to your favourable and expeditious response to this proposal. If you have any questions or concerns please do not hesitate to contact me directly.

Yours sincerely,



**Paul K. Baron**  
Principal

**Attachments:**

- Exhibit A - QA Services Summary
- Exhibit B - Work Zone Camera Invoices
- Exhibit C - Survey Invoices
- Exhibit D – EarthCam Invoices
- Exhibit E – Baza Gardens Sanitary Sewer Documents

**TABLE 3. SUMMARY OF MOD 06 COSTS (Baza Gardens – Four (4) Months)**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost (Four Months)
Project Manager	84	\$15,708	\$655	\$16,363
Civil Inspector	672	\$77,280	\$3,220	\$80,500
Expenses				\$25,026
<b>Total</b>	<b>756</b>	<b>\$92,988</b>	<b>\$3,875</b>	<b>\$121,889</b>

**TABLE 4. SUMMARY OF MOD 04, MOD 05, & MOD 06 TOTAL COSTS**

Description/Labor Class	Labor Hours	Estimated Labor Cost	GRT	Total Cost MOD 04, 05, & 06
Project Manager	964	\$185,548	\$7,732	\$193,280
Special Inspector	220	\$48,620	\$2,026	\$50,646
Civil Inspector	1552	\$183,760	\$7,657	\$191,417
Assistant PM	880	\$106,480	\$4,437	\$110,917
Special Inspector	880	\$110,880	\$4,620	\$115,500
Submittal/ RFI Manager	880	\$88,880	\$3,704	\$92,584
Scheduler	50	\$7,500	\$313	\$7,813
Expenses				\$60,475
<b>GRAND TOTAL</b>				<b>\$822,631</b>

We look forward to your favourable and expeditious response to this proposal. If you have any questions or concerns please do not hesitate to contact me directly.

Yours sincerely,



**Paul K. Baron**  
Principal

**Attachments:**

- Exhibit A - QA Services Summary
- Exhibit B - Work Zone Camera Invoices
- Exhibit C - Survey Invoices
- Exhibit D – EarthCam Invoices
- Exhibit E – Baza Gardens Sanitary Sewer Documents

**EXHIBIT A - QA SERVICES SUMMARY**

**GHD - PROJECT ESTIMATING SHEET- GHD EXPENSES**

**Project Name:** GWA Construction Agat-Santa Rita WWTP - **CM Services for MOD 04**  
**GHD Project Number:** 11109000  
**Prepared by:** Bryan J. Ryley  
**Date:**

**Attachment:**  
**of:**  
**Checked by:** Paul K. Baron  
**Date:**

EXPENSE ITEM	QUANTITY	UNIT COST	AMOUNT	MARKUP	TOTAL
<b>PRECONSTRUCTION PHASE TASKS</b>					
<b>SUBTOTAL</b>					
<b>CONSTRUCTION PHASE TASKS</b>					
Mileage (3 vehicles x 24 miles x 65 days)	4,680	\$ 0.52	\$ 2,433.60	\$ 365.04	\$ 2,798.64
Report Reproduction, misc	1	\$ 1,500.00	\$ 1,500.00	\$ 225.00	\$ 1,725.00
Live video feed, website access & maintenance (month)	13	\$ 325.00	\$ 4,225.00	\$ 633.75	\$ 4,858.75
CQA Compaction Testing	1	\$ 6,757.40	\$ 6,757.40	\$ 1,013.61	\$ 7,771.01
CQA Concrete Testing	1	\$ 2,580.60	\$ 2,580.60	\$ 387.09	\$ 2,967.69
CQA Survey Verification	1	\$ 10,493.76	\$ 10,493.76	\$ 1,574.06	\$ 12,067.82
<b>SUBTOTAL</b>			<b>\$ 27,990.36</b>	<b>\$ 4,198.55</b>	<b>\$ 32,188.91</b>
<b>POST CONSTRUCTION SERVICES</b>					
GHD Consumables (\$6.00/hour)					
<b>SUBTOTAL</b>					
<b>TOTAL</b>		<b>\$ -</b>	<b>\$ 27,990.36</b>	<b>\$ 4,198.55</b>	<b>\$ 32,188.91</b>

**GHD - PROJECT ESTIMATING SHEET- GHD EXPENSES**

**Project Name:** GWA Construction Agat-Santa Rita WWTP - **CM Services for MOD 05**  
**GHD Project Number:** 11109000  
**Prepared by:** Bryan J. Ryley  
**Date:**

**Attachment:**  
**of:**  
**Checked by:** Paul K. Baron  
**Date:**

EXPENSE ITEM	QUANTITY	UNIT COST	AMOUNT	MARKUP	TOTAL
<b>PRECONSTRUCTION PHASE TASKS</b>					
<b>SUBTOTAL</b>					
<b>CONSTRUCTION PHASE TASKS</b>					
Mileage (3 vehicles x 24 miles x 45 days)	3,240	\$ 0.52	\$ 1,684.80	\$ 252.72	\$ 1,937.52
Report Reproduction, misc	1	\$ 500.00	\$ 500.00	\$ 75.00	\$ 575.00
Live video feed, website access & maintenance (month)	2	\$ 325.00	\$ 650.00	\$ 97.50	\$ 747.50
CQA Compaction Testing		\$ -	\$ -	\$ -	\$ -
CQA Concrete Testing		\$ -	\$ -	\$ -	\$ -
CQA Survey Verification		\$ -	\$ -	\$ -	\$ -
<b>SUBTOTAL</b>			\$ 2,834.80	\$ 425.22	\$ 3,260.02
<b>POST CONSTRUCTION SERVICES</b>					
GHD Consumables (\$6.00/hour)					
<b>SUBTOTAL</b>					
<b>TOTAL</b>		\$ -	\$ 2,834.80	\$ 425.22	\$ 3,260.02

**GHD - PROJECT ESTIMATING SHEET- GHD EXPENSES**

**Project Name:** GWA Construction Agat-Santa Rita WWTP - **CM Services for MOD 06**  
**GHD Project Number:** 11109000  
**Prepared by:** Bryan J. Ryley  
**Date:**

**Attachment:**  
**of:**  
**Checked by:** Paul K. Baron  
**Date:**

EXPENSE ITEM	QUANTITY	UNIT COST	AMOUNT	MARKUP	TOTAL
<b>PRECONSTRUCTION PHASE TASKS</b>					
<b>SUBTOTAL</b>					
<b>CONSTRUCTION PHASE TASKS</b>					
Mileage (1.5 vehicles x 24 miles x 84 days)	3,024	\$ 0.52	\$ 1,572.48	\$ 235.87	\$ 1,808.35
Report Reproduction, misc	1	\$ 500.00	\$ 500.00	\$ 75.00	\$ 575.00
Live video feed, website access & maintenance (month)	4	\$ 325.00	\$ 1,300.00	\$ 195.00	\$ 1,495.00
CQA Compaction Testing	1	\$ 2,289.08	\$ 2,289.08	\$ 343.36	\$ 2,632.44
CQA Concrete Testing	0	\$ -	\$ -	\$ -	\$ -
CQA Survey Verification	1	\$ 16,100.00	\$ 16,100.00	\$ 2,415.00	\$ 18,515.00
<b>SUBTOTAL</b>			<b>\$ 21,761.56</b>	<b>\$ 3,264.23</b>	<b>\$ 25,025.79</b>
<b>POST CONSTRUCTION SERVICES</b>					
GHD Consumables (\$6.00/hour)					
<b>SUBTOTAL</b>					
<b>TOTAL</b>		<b>\$ -</b>	<b>\$ 21,761.56</b>	<b>\$ 3,264.23</b>	<b>\$ 25,025.79</b>

**GHD - PROJECT ESTIMATING SHEET - GHD QA SERVICES SUMMARY**

<b>Project Name:</b> GWA Construction Agat-Santa Rita WWTP - <b>QA Services for MOD 06</b>	<b>Attachment:</b>
<b>GHD Project Number:</b> 11109000	<b>of:</b>
<b>Prepared By:</b> Bryan J. Ryley	<b>Checked By:</b> Paul K. Baron
<b>Date:</b>	<b>Date:</b>

**QA SURVEY ESTIMATE**

<u>Sanitary Sewer Manholes</u>	<u>Quantity</u>	<u>Quantity</u>	<u>Cost</u>
Base Section	4	\$800	\$3,200
<u>Sanitary Sewer Pipeline</u>	<u>Quantity</u>	<u>Quantity</u>	<u>Cost</u>
Vertical Alignment (at 100 Ft. Stations)	8	\$1,200	\$9,600
<u>Bench Marks:</u>	<u>Quantity</u>	<u>Quantity</u>	<u>Cost</u>
Establish/Verify project bench	1	\$1,200	\$1,200
			Subtotal
			\$14,000
Half Day	<u>Rate</u> \$800	Contingency 15%	\$2,100
Full Day	\$1,200		
Hourly	\$150		
<b>TOTAL ESTIMATED BUDGET</b>			<b>\$16,100</b>

**CQA TESTING ESTIMATE**

**Material Laboratory Testing:**

<u>Procotor &amp; Sieve Analysis:</u>	<u>Quantity</u>	<u>Quantity</u>	<u>Cost</u>
Base Course	\$234.50	1	\$234.50
Fill Material	\$234.50	1	\$234.50
Bedding Material	\$234.50	1	\$234.50

**Compaction Testing:**

<u>Sanitary Sewer Pipeline</u>	<u>Quantity</u>	<u>Quantity</u>	<u>Cost</u>
Manhole Base Course	\$99.00	4	\$396.00
Sand Bedding	\$99.00	2	\$198.00
Backfill	\$99.00	5	\$495.00
Pavement Base Course	\$99.00	2	\$198.00
			Contingency 15%
			\$298.58
<b>TOTAL ESTIMATED BUDGET:</b>			<b>\$2,289.08</b>

**DESCRIPTION OF TESTS:**

Modified Proctor Test	\$115.00
Sieve Analysis	\$50.00
Soil Classification	\$38.50
Amount of Material in Soils Finer than No. 200 Sieve	\$31.00
	<b>SUBTOTAL: \$234.50</b>
Compaction Test - First Test \$49.50	\$49.50
Compaction Tests - Subsequent Tests \$16.50 (Assume 3 subsequent tests)	\$49.50
	<b>SUBTOTAL: \$99.00</b>
<b>GRAND TOTAL ESTIMATED QA TESTING BUDGET:</b>	
	<b>\$18,389</b>



**Quality Assurance Services Summary**

A	B	C	D	E	F
Item No.	Description of Work	Value	Total Amount to Date	Percent Complete	Remaining
1	QA Material Testing	\$ 28,871.00	\$ 20,819.60	72%	\$ 8,051.40
2	QA Concrete Testing	\$ 28,551.00	\$ 51,403.28	180%	\$ (22,852.28)
3	QA Survey	\$ 102,718.00	\$ 105,570.00	103%	\$ (2,852.00)
SubTotal		\$ 160,140.00	\$ 177,792.88	111%	\$ (17,652.88)

**Quality Assurance Material Testing Summary**

Invoice Date	Invoice Number	Sub-consultant	Description	Invoice Amount	Invoice Amount With Mark Up	Running Total Invoice Amount	Remaining Balance
							<b>\$28,871.00</b>
1/11/2016	1	PSET	Phase I QA Material Testing Services	\$ 1,603.50	\$ 1,844.03	\$ 1,844.03	\$27,026.98
2/10/2016	2	PSET	Phase I QA Material Testing Services	\$ 709.50	\$ 815.93	\$ 2,659.95	\$26,211.05
3/10/2016	3	PSET	Phase I QA Material Testing Services	\$ 1,835.00	\$ 2,110.25	\$ 4,770.20	\$24,100.80
4/10/2016	4	PSET	Phase I QA Material Testing Services	\$ 985.50	\$ 1,133.33	\$ 5,903.53	\$22,967.48
5/10/2016	5	PSET	Phase I QA Material Testing Services	\$ 742.50	\$ 853.88	\$ 6,757.40	\$22,113.60
8/22/2016	155-365.68	GEO	Phase II QA Material Testing Services	\$ 200.00	\$ 230.00	\$ 6,987.40	\$21,883.60
8/22/2016	156-365.68	GEO	Phase II QA Material Testing Services	\$ 720.00	\$ 828.00	\$ 7,815.40	\$21,055.60
8/22/2016	158-365.68	GEO	Phase II QA Material Testing Services	\$ 300.00	\$ 345.00	\$ 8,160.40	\$20,710.60
8/22/2016	159-365.68	GEO	Phase II QA Material Testing Services	\$ 95.00	\$ 109.25	\$ 8,269.65	\$20,601.35
9/21/2016	162-365.68	GEO	Phase II QA Material Testing Services	\$ 182.50	\$ 209.88	\$ 8,479.53	\$20,391.48
9/21/2016	163-365.68	GEO	Phase II QA Material Testing Services	\$ 808.00	\$ 929.20	\$ 9,408.73	\$19,462.28
9/21/2016	166-365.68	GEO	Phase II QA Material Testing Services	\$ 285.00	\$ 327.75	\$ 9,736.48	\$19,134.53
9/21/2016	167-365.68	GEO	Phase II QA Material Testing Services	\$ 170.00	\$ 195.50	\$ 9,931.98	\$18,939.03
5/31/2016	147-365.68	GEO	Phase II QA Material Testing Services	\$ 739.00	\$ 849.85	\$ 10,781.83	\$18,089.18
6/30/2016	151-365.68	GEO	Phase II QA Material Testing Services	\$ 750.00	\$ 862.50	\$ 11,644.33	\$17,226.68
10/18/2016	170-365.68	GEO	Phase II QA Material Testing Services	\$ 402.00	\$ 462.30	\$ 12,106.63	\$16,764.38
10/21/2016	173-365.68	GEO	Phase II QA Material Testing Services	\$ 234.00	\$ 269.10	\$ 12,375.73	\$16,495.28
10/21/2016	174-365.68	GEO	Phase II QA Material Testing Services	\$ 274.00	\$ 315.10	\$ 12,690.83	\$16,180.18
10/28/2016	178-365.68	GEO	Phase II QA Material Testing Services	\$ 75.00	\$ 86.25	\$ 12,777.08	\$16,093.93
11/11/2016	180-365.68	GEO	Phase II QA Material Testing Services	\$ 130.00	\$ 149.50	\$ 12,926.58	\$15,944.43
11/17/2016	182-365.68	GEO	Phase II QA Material Testing Services	\$ 95.00	\$ 109.25	\$ 13,035.83	\$15,835.18
11/18/2019	183-365.68	GEO	Phase II QA Material Testing Services	\$ 233.00	\$ 267.95	\$ 13,303.78	\$15,567.23
11/23/2016	184-365.68	GEO	Phase II QA Material Testing Services	\$ 194.00	\$ 223.10	\$ 13,526.88	\$15,344.13
11/28/2016	187-365.68	GEO	Phase II QA Material Testing Services	\$ 370.00	\$ 425.50	\$ 13,952.38	\$14,918.63
11/28/2016	188-365.69	GEO	Phase II QA Material Testing Services	\$ 190.00	\$ 218.50	\$ 14,170.88	\$14,700.13
11/28/2016	189-365.68	GEO	Phase II QA Material Testing Services	\$ 275.00	\$ 316.25	\$ 14,487.13	\$14,383.88
12/16/2016	194-365.68	GEO	Phase II QA Material Testing Services	\$ 170.00	\$ 195.50	\$ 14,682.63	\$14,188.38
12/30/2016	200-365.68	GEO	Phase II QA Material Testing Services	\$ 75.00	\$ 86.25	\$ 14,768.88	\$14,102.13
1/24/2017	208-365.68	GEO	Phase II QA Material Testing Services	\$ 210.00	\$ 241.50	\$ 15,010.38	\$13,860.63
3/31/2017	218-365.68	GEO	Phase II QA Material Testing Services	\$ 305.00	\$ 350.75	\$ 15,361.13	\$13,509.88
3/31/2017	219-365.68	GEO	Phase II QA Material Testing Services	\$ 174.00	\$ 200.10	\$ 15,561.23	\$13,309.78
3/31/2017	220-365.68	GEO	Phase II QA Material Testing Services	\$ 131.00	\$ 150.65	\$ 15,711.88	\$13,159.13
3/31/2017	224-365.68	GEO	Phase II QA Material Testing Services	\$ 192.00	\$ 220.80	\$ 15,932.68	\$12,938.33
4/28/2017	229-365.68	GEO	Phase II QA Material Testing Services	\$ 142.00	\$ 163.30	\$ 16,095.98	\$12,775.03
4/28/2017	231-365.68	GEO	Phase II QA Material Testing Services	\$ 218.00	\$ 250.70	\$ 16,346.68	\$12,524.33
5/11/2017	235-365.68	GEO	Phase II QA Material Testing Services	\$ 109.00	\$ 125.35	\$ 16,472.03	\$12,398.98
6/16/2017	246-365.67	GEO	Phase II QA Material Testing Services	\$ 349.00	\$ 401.35	\$ 16,873.38	\$11,997.63
6/19/2017	248-365.68	GEO	Phase II QA Material Testing Services	\$ 109.00	\$ 125.35	\$ 16,998.73	\$11,872.28
6/30/2017	254-365.68	GEO	Phase II QA Material Testing Services	\$ 87.00	\$ 100.05	\$ 17,098.78	\$11,772.23
7/10/2017	257-365.68	GEO	Phase II QA Material Testing Services	\$ 135.00	\$ 155.25	\$ 17,254.03	\$11,616.98
7/27/2017	264-365.68	GEO	Phase II QA Material Testing Services	\$ 87.00	\$ 100.05	\$ 17,354.08	\$11,516.93
8/31/2017	276-365.68	GEO	Phase II QA Material Testing Services	\$ 87.00	\$ 100.05	\$ 17,454.13	\$11,416.88
9/27/2017	287-365.68	GEO	Phase II QA Material Testing Services	\$ 109.00	\$ 125.35	\$ 17,579.48	\$11,291.53
10/31/2017	301-365.68	GEO	Phase II QA Material Testing Services	\$ 371.00	\$ 426.65	\$ 18,006.13	\$10,864.88
11/30/2017	323-365.68	GEO	Phase II QA Material Testing Services	\$ 176.00	\$ 202.40	\$ 18,208.53	\$10,662.48
12/29/2017	330-365.68	GEO	Phase II QA Material Testing Services	\$ 109.00	\$ 125.35	\$ 18,333.88	\$10,537.13
12/29/2017	337-365.68	GEO	Phase II QA Material Testing Services	\$ 395.00	\$ 454.25	\$ 18,788.13	\$10,082.88
12/29/2017	339-365.68	GEO	Phase II QA Material Testing Services	\$ 278.00	\$ 319.70	\$ 19,107.83	\$9,763.18
1/31/2018	342-365.68	GEO	Phase II QA Material Testing Services	\$ 403.00	\$ 463.45	\$ 19,571.28	\$9,299.73
1/31/2018	343-365.68	GEO	Phase II QA Material Testing Services	\$ 239.00	\$ 274.85	\$ 19,846.13	\$9,024.88
1/31/2018	344-365.68	GEO	Phase II QA Material Testing Services	\$ 162.00	\$ 186.30	\$ 20,032.43	\$8,838.58
1/31/2018	372-365.68	GEO	Phase II QA Material Testing Services	\$ 422.50	\$ 485.88	\$ 20,518.30	\$8,352.70
1/31/2018	373-365.68	GEO	Phase II QA Material Testing Services	\$ 262.00	\$ 301.30	\$ 20,819.60	\$8,051.40

**Quality Assurance Concrete Testing Summary**

Invoice Date	Invoice Number	Sub-consultant	Description	Invoice Amount	Invoice Amount With Mark Up	Running Total Invoice Amount	Remaining Balance
							\$28,551.00
2/10/2016	2	PSET	Phase I QA Testing Services	\$ 405.00	\$ 465.75	\$ 465.75	\$28,085.25
3/10/2016	3	PSET	Phase I QA Testing Services	\$ 433.50	\$ 498.53	\$ 964.28	\$27,586.73
4/10/2016	4	PSET	Phase I QA Testing Services	\$ 495.00	\$ 569.25	\$ 1,533.53	\$27,017.48
5/10/2016	5	PSET	Phase I QA Testing Services	\$ 910.50	\$ 1,047.08	\$ 2,580.60	\$25,970.40
8/22/2016	157-365.68	GEO	Phase II QA Testing Services	\$ 606.50	\$ 697.48	\$ 3,278.08	\$25,272.93
8/30/2016	160-365.68	GEO	Phase II QA Testing Services	\$ 444.00	\$ 510.60	\$ 3,788.68	\$24,762.33
8/30/2016	161-365.68	GEO	Phase II QA Testing Services	\$ 569.00	\$ 654.35	\$ 4,443.03	\$24,107.98
9/21/2016	164-365.68	GEO	Phase II QA Testing Services	\$ 287.00	\$ 330.05	\$ 4,773.08	\$23,777.93
9/21/2016	165-365.68	GEO	Phase II QA Testing Services	\$ 287.00	\$ 330.05	\$ 5,103.13	\$23,447.88
9/29/2016	168-365.68	GEO	Phase II QA Testing Services	\$ 344.00	\$ 395.60	\$ 5,498.73	\$23,052.28
9/29/2016	169-365.68	GEO	Phase II QA Testing Services	\$ 264.00	\$ 303.60	\$ 5,802.33	\$22,748.68
10/18/2016	170-365.68	GEO	Phase II QA Testing Services	\$ 110.00	\$ 126.50	\$ 5,928.83	\$22,622.18
10/21/2016	171-365.68	GEO	Phase II QA Testing Services	\$ 241.00	\$ 277.15	\$ 6,205.98	\$22,345.03
10/21/2016	172-365.68	GEO	Phase II QA Testing Services	\$ 287.00	\$ 330.05	\$ 6,536.03	\$22,014.98
10/24/2016	175-365.68	GEO	Phase II QA Testing Services	\$ 252.50	\$ 290.38	\$ 6,826.40	\$21,724.60
10/27/2016	176-365.68	GEO	Phase II QA Testing Services	\$ 287.00	\$ 330.05	\$ 7,156.45	\$21,394.55
10/28/2016	177-365.68	GEO	Phase II QA Testing Services	\$ 287.00	\$ 330.05	\$ 7,486.50	\$21,064.50
11/11/2016	179-365.68	GEO	Phase II QA Testing Services	\$ 287.00	\$ 330.05	\$ 7,816.55	\$20,734.45
11/11/2016	180-365.68	GEO	Phase II QA Testing Services	\$ 224.00	\$ 257.60	\$ 8,074.15	\$20,476.85
11/11/2016	181-365.68	GEO	Phase II QA Testing Services	\$ 379.00	\$ 435.85	\$ 8,510.00	\$20,041.00
11/17/2016	182-365.68	GEO	Phase II QA Testing Services	\$ 275.50	\$ 316.83	\$ 8,826.83	\$19,724.18
11/18/2016	183-365.68	GEO	Phase II QA Testing Services	\$ 132.00	\$ 151.80	\$ 8,978.63	\$19,572.38
11/28/2016	185-365.68	GEO	Phase II QA Testing Services	\$ 287.00	\$ 330.05	\$ 9,308.68	\$19,242.33
11/28/2016	186-365.68	GEO	Phase II QA Testing Services	\$ 264.00	\$ 303.60	\$ 9,612.28	\$18,938.73
12/16/2016	190-365.68	GEO	Phase II QA Testing Services	\$ 346.00	\$ 397.90	\$ 10,010.18	\$18,540.83
12/16/2016	191-365.68	GEO	Phase II QA Testing Services	\$ 310.00	\$ 356.50	\$ 10,366.68	\$18,184.33
12/16/2016	192-365.68	GEO	Phase II QA Testing Services	\$ 310.00	\$ 356.50	\$ 10,723.18	\$17,827.83
12/16/2016	193-365.68	GEO	Phase II QA Testing Services	\$ 310.00	\$ 356.50	\$ 11,079.68	\$17,471.33
12/20/2016	195-365.68	GEO	Phase II QA Testing Services	\$ 288.00	\$ 331.20	\$ 11,410.88	\$17,140.13
12/21/2016	196-365.68	GEO	Phase II QA Testing Services	\$ 631.50	\$ 726.23	\$ 12,137.10	\$16,413.90
12/30/2016	197-365.68	GEO	Phase II QA Testing Services	\$ 677.50	\$ 779.13	\$ 12,916.23	\$15,634.78
12/30/2016	198-365.68	GEO	Phase II QA Testing Services	\$ 310.00	\$ 356.50	\$ 13,272.73	\$15,278.28
12/30/2016	199-365.68	GEO	Phase II QA Testing Services	\$ 331.50	\$ 381.23	\$ 13,653.95	\$14,897.05
12/30/2016	200-365.68	GEO	Phase II QA Testing Services	\$ 346.00	\$ 397.90	\$ 14,051.85	\$14,499.15
1/20/2017	201-365.68	GEO	Phase II QA Testing Services	\$ 356.50	\$ 409.98	\$ 14,461.83	\$14,089.18
1/20/2017	202-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 14,828.68	\$13,722.33
1/20/2017	203-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 15,166.78	\$13,384.23
1/20/2017	204-365.68	GEO	Phase II QA Testing Services	\$ 283.50	\$ 326.03	\$ 15,492.80	\$13,058.20
1/20/2017	205-365.68	GEO	Phase II QA Testing Services	\$ 291.50	\$ 335.23	\$ 15,828.03	\$12,722.98
1/20/2017	206-365.68	GEO	Phase II QA Testing Services	\$ 369.00	\$ 424.35	\$ 16,252.38	\$12,298.63
1/20/2017	207-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 16,619.23	\$11,931.78
1/24/2017	208-365.68	GEO	Phase II QA Testing Services	\$ 356.50	\$ 409.98	\$ 17,029.20	\$11,521.80
2/13/2017	209-365.68	GEO	Phase II QA Testing Services	\$ 495.50	\$ 569.83	\$ 17,599.03	\$10,951.98
2/13/2017	210-365.68	GEO	Phase II QA Testing Services	\$ 369.00	\$ 424.35	\$ 18,023.38	\$10,527.63
2/22/2017	211-365.68	GEO	Phase II QA Testing Services	\$ 394.00	\$ 453.10	\$ 18,476.48	\$10,074.53
2/22/2017	212-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 18,843.33	\$9,707.68
2/28/2017	213-365.68	GEO	Phase II QA Testing Services	\$ 473.00	\$ 543.95	\$ 19,387.28	\$9,163.73
2/28/2017	214-365.68	GEO	Phase II QA Testing Services	\$ 563.00	\$ 647.45	\$ 20,034.73	\$8,516.28
2/28/2017	215-365.68	GEO	Phase II QA Testing Services	\$ 269.00	\$ 309.35	\$ 20,344.08	\$8,206.93
3/31/2017	216-365.68	GEO	Phase II QA Testing Services	\$ 344.00	\$ 395.60	\$ 20,739.68	\$7,811.33
3/31/2017	217-365.68	GEO	Phase II QA Testing Services	\$ 272.00	\$ 312.80	\$ 21,052.48	\$7,498.53
3/31/2017	221-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 21,419.33	\$7,131.68
3/31/2017	222-365.68	GEO	Phase II QA Testing Services	\$ 381.50	\$ 438.73	\$ 21,858.05	\$6,692.95
3/31/2017	223-365.68	GEO	Phase II QA Testing Services	\$ 442.00	\$ 508.30	\$ 22,366.35	\$6,184.65
4/7/2017	225-365.68	GEO	Phase II QA Testing Services	\$ 394.00	\$ 453.10	\$ 22,819.45	\$5,731.55
4/17/2017	227-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 23,186.30	\$5,364.70
4/28/2017	228-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 23,524.40	\$5,026.60
5/11/2017	232-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 23,862.50	\$4,688.50
5/11/2017	233-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 24,200.60	\$4,350.40
5/11/2017	234-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 24,538.70	\$4,012.30
5/11/2017	237-365.67	GEO	Phase II QA Testing Services	\$ 337.50	\$ 388.13	\$ 24,926.83	\$3,624.18
5/31/2017	238-365.68	GEO	Phase II QA Testing Services	\$ 281.50	\$ 323.73	\$ 25,250.55	\$3,300.45
5/31/2017	239-365.67	GEO	Phase II QA Testing Services	\$ 307.50	\$ 353.63	\$ 25,604.18	\$2,946.83
5/31/2017	240-365.67	GEO	Phase II QA Testing Services	\$ 131.00	\$ 150.65	\$ 25,754.83	\$2,796.18
6/16/2017	241-365.68	GEO	Phase II QA Testing Services	\$ 394.00	\$ 453.10	\$ 26,207.93	\$2,343.08
6/16/2017	243-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 26,574.78	\$1,976.23
6/16/2017	244-365.68	GEO	Phase II QA Testing Services	\$ 331.50	\$ 381.23	\$ 26,956.00	\$1,595.00
6/16/2017	245-365.68	GEO	Phase II QA Testing Services	\$ 381.50	\$ 438.73	\$ 27,394.73	\$1,156.28

**Quality Assurance Concrete Testing Summary**

6/16/2017	246-365.68	GEO	Phase II QA Testing Services	\$ 349.00	\$ 401.35	\$ 27,796.08	\$754.93
6/16/2017	247-365.68	GEO	Phase II QA Testing Services	\$ 236.00	\$ 271.40	\$ 28,067.48	\$483.53
6/19/2017	248-365.68	GEO	Phase II QA Testing Services	\$ 109.00	\$ 125.35	\$ 28,192.83	\$358.18
6/22/2017	249-365.68	GEO	Phase II QA Testing Services	\$ 592.00	\$ 680.80	\$ 28,873.63	-\$322.62
6/30/2017	250-365.67	GEO	Phase II QA Testing Services	\$ 488.00	\$ 561.20	\$ 29,434.83	-\$883.82
6/30/2017	251-365.67	GEO	Phase II QA Testing Services	\$ 481.50	\$ 553.73	\$ 29,988.55	-\$1,437.55
6/30/2017	252-365.67	GEO	Phase II QA Testing Services	\$ 231.50	\$ 266.23	\$ 30,254.78	-\$1,703.77
6/30/2017	253-365.68	GEO	Phase II QA Testing Services	\$ 269.00	\$ 309.35	\$ 30,564.13	-\$2,013.12
7/10/2017	255-365.68	GEO	Phase II QA Testing Services	\$ 306.00	\$ 351.90	\$ 30,916.03	-\$2,365.02
7/10/2017	257-365.68	GEO	Phase II QA Testing Services	\$ 100.00	\$ 115.00	\$ 31,031.03	-\$2,480.02
7/14/2017	261-365.68	GEO	Phase II QA Testing Services	\$ 513.00	\$ 589.95	\$ 31,620.98	-\$3,069.97
7/27/2017	264-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 31,959.08	-\$3,408.07
7/31/2017	265-365.69	GEO	Phase II QA Testing Services	\$ 225.00	\$ 258.75	\$ 32,217.83	-\$3,666.82
8/24/2017	266-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 32,555.93	-\$4,004.92
8/24/2017	267-365.68	GEO	Phase II QA Testing Services	\$ 613.00	\$ 704.95	\$ 33,260.88	-\$4,709.87
8/24/2017	268-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 33,598.98	-\$5,047.97
9/21/2017	281-365.68	GEO	Phase II QA Testing Services	\$ 583.00	\$ 670.45	\$ 34,269.43	-\$5,718.42
9/21/2017	282-365.68	GEO	Phase II QA Testing Services	\$ 299.00	\$ 343.85	\$ 34,613.28	-\$6,062.27
9/21/2017	283-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 34,951.38	-\$6,400.37
9/27/2017	285-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 35,318.23	-\$6,767.22
9/27/2017	286-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 35,685.08	-\$7,134.07
9/27/2017	287-365.68	GEO	Phase II QA Testing Services	\$ 269.00	\$ 309.35	\$ 35,994.43	-\$7,443.42
9/29/2017	288-365.68	GEO	Phase II QA Testing Services	\$ 269.00	\$ 309.35	\$ 36,303.78	-\$7,752.77
10/17/2017	296-365.68	GEO	Phase II QA Testing Services	\$ 760.00	\$ 874.00	\$ 37,177.78	-\$8,626.77
10/17/2017	297-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 37,515.88	-\$8,964.87
10/17/2017	298-365.68	GEO	Phase II QA Testing Services	\$ 516.00	\$ 593.40	\$ 38,109.28	-\$9,558.27
10/31/2017	305-365.68	GEO	Phase II QA Testing Services	\$ 588.00	\$ 676.20	\$ 38,785.48	-\$10,234.48
10/31/2017	299-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 39,152.32	-\$10,601.32
10/31/2017	300-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 39,519.18	-\$10,968.18
10/31/2017	306-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 39,886.03	-\$11,335.03
11/24/2017	307-365.68	GEO	Phase II QA Testing Services	\$ 309.50	\$ 355.93	\$ 40,241.95	-\$11,690.95
11/24/2017	308-365.68	GEO	Phase II QA Testing Services	\$ 380.00	\$ 437.00	\$ 40,678.95	-\$12,127.95
11/24/2017	309-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 41,045.80	-\$12,494.80
11/24/2017	310-365.68	GEO	Phase II QA Testing Services	\$ 297.00	\$ 341.55	\$ 41,387.35	-\$12,836.35
11/24/2017	311-365.68	GEO	Phase II QA Testing Services	\$ 247.00	\$ 284.05	\$ 41,671.40	-\$13,120.40
11/30/2017	323-365.68	GEO	Phase II QA Testing Services	\$ 344.00	\$ 395.60	\$ 42,067.00	-\$13,516.00
11/30/2017	324-365.68	GEO	Phase II QA Testing Services	\$ 344.00	\$ 395.60	\$ 42,462.60	-\$13,911.60
12/29/2017	325-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 42,829.45	-\$14,278.45
12/29/2017	326-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 43,196.30	-\$14,645.30
12/29/2017	327-365.68	GEO	Phase II QA Testing Services	\$ 860.00	\$ 989.00	\$ 44,185.30	-\$15,634.30
12/29/2017	328-365.68	GEO	Phase II QA Testing Services	\$ 563.00	\$ 647.45	\$ 44,832.75	-\$16,281.75
12/29/2017	329-365.68	GEO	Phase II QA Testing Services	\$ 525.50	\$ 604.33	\$ 45,437.07	-\$16,886.07
12/29/2017	338-365.68	GEO	Phase II QA Testing Services	\$ 269.00	\$ 309.35	\$ 45,746.42	-\$17,195.42
1/31/2017	345-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 46,113.27	-\$17,562.27
1/31/2017	346-365.68	GEO	Phase II QA Testing Services	\$ 319.00	\$ 366.85	\$ 46,480.12	-\$17,929.12
1/31/2017	347-365.68	GEO	Phase II QA Testing Services	\$ 306.50	\$ 352.48	\$ 46,832.60	-\$18,281.60
1/31/2017	348-365.68	GEO	Phase II QA Testing Services	\$ 369.00	\$ 424.35	\$ 47,256.95	-\$18,705.95
1/31/2017	363-365.68	GEO	Phase II QA Testing Services	\$ 473.00	\$ 543.95	\$ 47,800.90	-\$19,249.90
1/31/2017	364-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 48,139.00	-\$19,588.00
1/31/2017	365-365.68	GEO	Phase II QA Testing Services	\$ 563.00	\$ 647.45	\$ 48,786.45	-\$20,235.45
1/31/2017	366-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 49,124.55	-\$20,573.55
1/31/2017	367-365.68	GEO	Phase II QA Testing Services	\$ 349.00	\$ 401.35	\$ 49,525.90	-\$20,974.90
1/31/2017	368-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 49,864.00	-\$21,313.00
1/31/2017	369-365.68	GEO	Phase II QA Testing Services	\$ 419.00	\$ 481.85	\$ 50,345.85	-\$21,794.85
1/31/2017	370-365.68	GEO	Phase II QA Testing Services	\$ 294.00	\$ 338.10	\$ 50,683.95	-\$22,132.95
1/31/2017	371-365.68	GEO	Phase II QA Testing Services	\$ 625.50	\$ 719.33	\$ 51,403.27	-\$22,852.27

**Quality Assurance Survey Verification Summary**

Date	Invoice Number	Description	Invoice Amount	Invoice amount with 15% Mark Up	Running Total Invoice Amount	Remaining Balance
						\$102,718.00
04/05/16	2016-054	Ed, 2016-054 Patrick	\$ 1,200.00	\$ 1,380.00	\$ 1,380.00	\$101,338.00
04/06/16	2016-054	3MFD, Retrace boundary points and establish vertical points. Completed. Ed, Patrick, Gerard	\$ 1,200.00	\$ 1,380.00	\$ 2,760.00	\$99,958.00
04/11/16	2016-054	2MFD, Verification of Gambion Wall. Completed. Ed, Patrick	\$ 1,200.00	\$ 1,380.00	\$ 4,140.00	\$98,578.00
04/26/16	2016-054	2MFD, Layout of Centerline of Road "A" Sta, 2+0, 6+00, 10+00, 14+00. Completed. Ed, Patrick	\$ 1,200.00	\$ 1,380.00	\$ 5,520.00	\$97,198.00
05/10/16	2016-054	2MFD, Elevation verification of all Spillway, Storm Drain invert and pipe elevation. Vertical and Horizontal datum of trapezoidal concrete swale. Completed. Ed, Patrick	\$ 1,200.00	\$ 1,380.00	\$ 6,900.00	\$95,818.00
05/23/16	2016-054	2MHD, Verify project site survey control points; vertical and horizontal. Completed. Ed, Patrick	\$ 900.00	\$ 1,035.00	\$ 7,935.00	\$94,783.00
05/25/16	2016-054	2MFD, Vertical verification of Oxidation Ditches. Completed. Ed, Patrick	\$ 1,200.00	\$ 1,380.00	\$ 9,315.00	\$93,403.00
05/31/16	2016-054	2MHD, Vertical verification of Oxidation Ditch	\$ 900.00	\$ 1,035.00	\$ 10,350.00	\$92,368.00
06/01/16	2016-054	2MHD, Verify horizontal Oxidation Ditch corner	\$ 900.00	\$ 1,035.00	\$ 11,385.00	\$91,333.00
06/28/16	2016-054	2MHD, Verification of Oxidation Ditch layout	\$ 900.00	\$ 1,035.00	\$ 12,420.00	\$90,298.00
07/20/16	2016-054	2MFD, Oxidation Ditch 1 & 2, Area 4 & 2, Topo Slab 10X10 Grid Asbuilt-Asbuilt of top of slab; Area 4 set, traverse, & set elevation	\$ 1,200.00	\$ 1,380.00	\$ 13,800.00	\$88,918.00
07/22/16	2016-054	2MFD, Oxidation Ditch 1 & 2, Area 4 & 2, Topo Slab 10X10 Grid Asbuilt-Asbuilt area 4 completed; Area 2 completed partially	\$ 1,200.00	\$ 1,380.00	\$ 15,180.00	\$87,538.00
07/25/16	2016-054	2MFD, Oxidation Ditch 1 & 2, Area 4 & 2, Topo Slab 10X10 Grid Asbuilt-Asbuilt completed	\$ 1,200.00	\$ 1,380.00	\$ 16,560.00	\$86,158.00
07/29/16	2016-054	2MFD, Asbuilt of Oxidation Ditch 1 & 2 area 3 & 1 top of slab- grid of 10x10- Area 3 completed and portion of Area 1	\$ 1,200.00	\$ 1,380.00	\$ 17,940.00	\$84,778.00
08/01/16	2016-054.02	2MHD, Asbuilt Oxidation Ditch 1 & 2 area 1 - Top of Slab 10' X 10' interval-portion of area 1 completed.	\$ 900.00	\$ 1,035.00	\$ 18,975.00	\$83,743.00
08/08/16	2016-054.02	2MFD, Asbuilt of Oxidation Ditch 1 & 2 area 1-top of slab 10' X 10' grid-completed	\$ 1,200.00	\$ 1,380.00	\$ 20,355.00	\$82,363.00
08/13/16	2016-054.02	2MFD, Asbuilt of clarifier No. 1 by 8 section; Crew: Ed, Pat	\$ 1,200.00	\$ 1,380.00	\$ 21,735.00	\$80,983.00
09/28/16	2016-054.02	2MHD, Horizontal & Vertical check on sludge piping of Tipalas substation: work completed	\$ 900.00	\$ 1,035.00	\$ 22,770.00	\$79,948.00
10/13/16	2016-054.03	2MHD, Asbuilt of ultra violet disinfection and sludge piping to clarifier (Ed, Patrick)	\$ 900.00	\$ 1,035.00	\$ 23,805.00	\$78,913.00
10/18/16	2016-054.03	2MHD, Asbuilt of sludge piping various area (Ed, Patrick)	\$ 900.00	\$ 1,035.00	\$ 24,840.00	\$77,878.00
10/21/16	2016-054.03	2MHD, As built of sludge piping various area - UV Inlet & Outlet pipe ; Secondary clarifier - Supply pipe to Oxidation Ditch and effluent pipe elbow/pipe deflection @ sta . 1+37.39 (Ed , Patrick)	\$ 900.00	\$ 1,035.00	\$ 25,875.00	\$76,843.00
10/28/16	2016-054.03	3MHD,Asbuilt of UV inlet. clarifier 2 piping to Oxidation Ditch and process drainage- pipe force main (Ed , Raughly , Patrick)	\$ 900.00	\$ 1,035.00	\$ 26,910.00	\$75,808.00
10/31/16	2016-054.03	2MFD, Oxidation Ditch out to secondary clarifier as built , Oxidation Ditch Inlet structure spot elevation, 30' effluent pipe as built and Oxidation Ditch roof spot elevation . (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 28,290.00	\$74,428.00
11/03/16	2016-054.04	2MFD, Asbuilt of oxidation Inlet structure, elevation check on oxidation ditch Inlet pipe, oxidation outlet pipe to secondary clarifier elevation check and process drainage pipe force main asbuilt, Ed, Patrick	\$ 1,200.00	\$ 1,380.00	\$ 29,670.00	\$73,048.00
11/16/16	2016-054.04	2MFD, Verify elevation of Influent, onsite lift station & process drainage pipe force main, Ultraviolet Inlet pipe to secondary clarifiers, Secondary clarifying I pipe to Ultraviolet, Oxidation ditch I floor elevation- roof,	\$ 1,200.00	\$ 1,380.00	\$ 31,050.00	\$71,668.00
11/23/16	2016-054.04	2MFD, Rae/Was pump station pipe, Manifold elevation check, Force main pipe check, Oxidation ditch Inlet structure- Inlet and outlet pipe vertical elevation check, Portion of secondary clarifier 2-base and sub-base	\$ 1,200.00	\$ 1,380.00	\$ 32,430.00	\$70,288.00
11/30/16	2016-054.04	2MFD, Rechecked oxidation ditch Inlet structure piping, Effluent pipe, Force main piping Influent pipe; Onsite lift station; Process drainage piping, Equalization overflow pipe and drain pipe, Ed, Patrick	\$ 1,200.00	\$ 1,380.00	\$ 33,810.00	\$68,908.00
12/05/16	2016-054.05	2MHD, Second Clarifier No. 2 Sludge Pipe elevation check@ deflection and end; Scum Pump Station foundation and elevation check: Influent Pipe elevation check@	\$ 900.00	\$ 1,035.00	\$ 34,845.00	\$67,873.00
12/09/16	2016-054.05	2MFD, As-built of Sludge Piping to Clarifier 1 & 2; Scum Pump Station foundation -054.05 vertical check: 3- 12" Sludae Pioina (cf) RAS/ WAS vertical check: Re-survey	\$ 1,200.00	\$ 1,380.00	\$ 36,225.00	\$66,493.00
12/20/16	2016-054.05	2MFD, Secondary Clarifier Sludge pipe@ RAS/WAS pump station-resurvey; -054.05 Ultraviolet Inlet pipe elbow: Oxidation Ditch 1 Influent Flow: RAS/WAS pump station	\$ 1,200.00	\$ 1,380.00	\$ 37,605.00	\$65,113.00
12/21/16	2016-054.05	2MFD, RAS/WAS pump station manhole; Oxidation Ditch 1 Influent Flow-resurvey -054.05 (Crew: Ed and Patrick)	\$ 1,200.00	\$ 1,380.00	\$ 38,985.00	\$63,733.00
01/03/17	2016-054.06	3MFD, see attachment (Ed, Pat, Raughly)	\$ 1,200.00	\$ 1,380.00	\$ 40,365.00	\$62,353.00
01/04/17	2016-054.06	2MFD, SMHvertical check-resurvey; Weir Gate Oxidation Ditch 1 & 2; RAS pipe from Oxidation Ditch 1 & 2; Recalculate elevation of Secondary Clarifier based on	\$ 1,200.00	\$ 1,380.00	\$ 41,745.00	\$60,973.00

**Quality Assurance Survey Verification Summary**

01/12/17	2016-054.06	2MFD, As-built of: Sludge piping: Oxidation Ditch 1 Influent flow pipe 24"; 30" Secondary Clarifier 3 piping; Oxidation Ditch Influent flow slab & inlet; Secondary	\$ 1,200.00	\$ 1,380.00	\$ 43,125.00	\$59,593.00
01/13/17	2016-054.06	2MHD, As-built of: 30" Effluent pipe at Station 0+00 & Station 0+14.17; 24" pipe thimble at Influent flow control gate-Oxidation Ditch 1 (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 44,160.00	\$58,558.00
01/20/17	2016-054.06	2MFD: As-built 0+00 & 0+14.17 for yard piping 30" effluent pipe, resurvey; As-built 0+00, 0+06.49, 0+58.8, & 0+77.85 for Secondary Clarifier, Resurvey (Gerard, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 45,540.00	\$57,178.00
01/23/17	2016-054.06	2MHD, As-built of Secondary Clarifier No. 2 form work-vertical and horizontal check (see field book no. 1061 p. 20-21), SS.41, Sheet 320 of 634 (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 46,575.00	\$56,143.00
01/26/17	2016-054.06	2MHD, As-built of 30" Effluent pipe at station 3+10.33 and station 3+31.20; As-built of Influent box finish slab; As-built of weir gate at Oxidation Ditch inlet structure (Ed,	\$ 900.00	\$ 1,035.00	\$ 47,610.00	\$55,108.00
01/30/17	2016-054.06	2MFD, As-built of Secondary Clarifier 2 pipe; As-built of Ultraviolet Disinfection slab (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 48,990.00	\$53,728.00
12/28/16	2016-054.07	3MHD, Resurveyed Secondary Clarifier Sludge Piping at Tupalao Pump Station: Force Main piping vertical and horizontal check: Secondary Clarifier 2 base course	\$ 900.00	\$ 1,035.00	\$ 50,025.00	\$52,693.00
02/09/17	2016-054.07	2MFD, As-built of 24" pipe thimble @ Oxidation Ditch 2: Influent flow pipe: As-built of yard piping-Eq.drainpipe and Eq. overflow pipe: As-built of R.A.S. flow meter	\$ 1,200.00	\$ 1,380.00	\$ 51,405.00	\$51,313.00
02/15/17	2016-054.07	2MFD, As-built of Secondary Clarifier 1 Weir Plate; Yard piping = Influent line, On-site lift station and processd draingae pipe: Yard piping=Equalization Drain Pipe	\$ 1,200.00	\$ 1,380.00	\$ 52,785.00	\$49,933.00
02/20/17	2016-054.07	2MHD, Yard Piping - Ultra violet Supply Pipe to Secondary Clarifier No. 2 24": Ultra violet Disinfection Weir (Ed, Patrick)	\$ 900.00	\$ 1,035.00	\$ 53,820.00	\$48,898.00
03/01/17	2016-054.08	2MFD, As built of Headworks-sub-base course (Ed, Pat)	\$ 1,200.00	\$ 1,380.00	\$ 55,200.00	\$47,518.00
03/03/17	2016-054.08	2M D, As-built of Oxidation Ditch Inlet Structure-Lower evel Plan 16" 24" and 30" pipes: As-built of Tupalao (Effluent) Pump Station force main 16" and 6" As built of	\$ 1,200.00	\$ 1,380.00	\$ 56,580.00	\$46,138.00
03/09/17	2016-054.08	2MHD, Oxidation Ditch Inlet piping 24" (resurvey); Secondary Clarifier No 1 Weir and Baffle-Manhole at Tupalao (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 57,615.00	\$45,103.00
03/16/17	2016-054.08	2MHD, Headworks sub-grade as-built (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 58,650.00	\$44,068.00
03/28/16	2016-054.08	2MFD, As built of Headworks top of slab form work, As-built of Secondary Clarifier 2 lander channels: Asbuilt of Digester Tank Subbase course (Ed, Roughly)	\$ 1,200.00	\$ 1,380.00	\$ 60,030.00	\$42,688.00
03/31/16	2016-054.08	3MFD, Secondary Clarifier No 2 Lander Channel as-built; Horizontal as- built of Headworks-Lower Level, As-built of Aerobic Digester Sludge Digester No 1 and 2 sub	\$ 1,200.00	\$ 1,380.00	\$ 61,410.00	\$41,308.00
04/04/17	2016-054.09	3MFD, As-built of Aerobic Digester Tank 1 & 2 Top of base course: Return Activated Sludge pipe as-built at Sta. +281.38: As-built of Sludge Digester Tank pipe Co":	\$ 1,200.00	\$ 1,380.00	\$ 62,790.00	\$39,928.00
04/10/17	2016-054.09	2MFD, As-built of Aerobic Digester top of base course; As-built of Return Activated Sludge pipe at Station 2+42.65 and at Station 2+22.65: Station 0+35 and 0+72; As-	\$ 1,200.00	\$ 1,380.00	\$ 64,170.00	\$38,548.00
04/12/17	2016-054.09	2MFD, Return Activated Sludge piping: As-built of Secondary Clarifier 2 Lauder Channel: As-built of Aerobic Digester top of base course (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 65,550.00	\$37,168.00
04/18/17	2016-054.09	2MHD 12" Sludge Pipe at 4+2 and Sta 4+50 from Secondary Clarifier 1 & 2: As-built of Secondary Clarifier 2 Launder Channel top of slab	\$ 900.00	\$ 1,035.00	\$ 66,585.00	\$36,133.00
05/04/17	2016-054.10	2MFD, As-built of Hyundai Waterline Sta. 13+60 to Sta. 16+31.44; Set control stations/ bench mark; Oxidation Ditch 2 topo of slab/ form work (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 67,965.00	\$34,753.00
05/10/17	2016-054.10	3MHD, Sewer line at Agat Treatment Plant (Ga'an) site relief sewer line man hole; Sewer line from SMH3 to SMH4 (Ed, Gerard, Joseph)	\$ 900.00	\$ 1,035.00	\$ 69,000.00	\$33,718.00
05/12/17	2016-054.10	3MHD, 30" sewer line at Ga'an Sewer Treatment Plant; Head works; TOS as-built (Ed, Allan, Patrick)	\$ 900.00	\$ 1,035.00	\$ 70,035.00	\$32,683.00
05/15/17	2016-054.10	2MFD, Ga'an 30" sewer line as-built; Headwork foundation at wet well as- built and pipe; Digestion Tank 1 and 2 foundation TOS as-built (Ed, Virgilio)	\$ 1,200.00	\$ 1,380.00	\$ 71,415.00	\$31,303.00
05/17/17	2016-054.10	2MHD, Ga'an 30" sewer line as-built; 8" sewer line between M H3 and M H4 as-built; 12" sludge pipe at 4+11.92 Secondary Clarifier B (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 72,450.00	\$30,268.00
05/25/17	2016-054.10	2MFD, Ga'an 30" sewer line at 1 +01.82 and 1 +29.82 as-built (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 73,830.00	\$28,888.00
05/26/17	2016-054.10	2MFD, Sewer manhole 2, 3, 4, 6, 7; Return activated sludge piping at Sta. 0+72.53 to 1 +21.22; Sewer line between sewer manhole 2 and sewer manhole 3	\$ 1,200.00	\$ 1,380.00	\$ 75,210.00	\$27,508.00
05/30/17	2016-054.10	2MHD, As-built of sewer line between SMH3 and SMH2 and sewer line between SMH6 and SMH7 (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 76,245.00	\$26,473.00
06/01/17	2016-054.11	3MHD, As-built of sewer line between SMH 5 and SMH6; As-built of Return Activated Sludge Pipe (Ed, Roughly, Allan)	\$ 900.00	\$ 1,035.00	\$ 77,280.00	\$25,438.00

**Quality Assurance Survey Verification Summary**

06/09/17	2016-054.11	2MHD, Dewatering Centrifuge Building As-built-top of base course and location; Ga'an 30' sewer line @ Sta 0+00 (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 78,315.00	\$24,403.00
06/12/17	2016-054.11	2MFD, As-built@ Ga'an 30" Sewerline; As-built Aerobic Digestion Tank no. 2; As-built Sewerline between SMH 2 and SMH 5; As-built Dewatering Centrifuge building	\$ 1,200.00	\$ 1,380.00	\$ 79,695.00	\$23,023.00
06/26/17	2016-054.11	2 MFD, As-built of 16" force main sewer pipe- Equalization tank to head works; As-built of 6" scum pump to sludge thickening line; As-built of sewer line "C" between	\$ 1,200.00	\$ 1,380.00	\$ 81,075.00	\$21,643.00
07/05/17	2016-054.12	2MFD, Aerobic Digester Influent Line 6"; Sewer line between SMH1 and SMH 2; 6" Waste Activated Sludge Pipe; Retaining Wall at Secondary Clarifier 2 (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 82,455.00	\$20,263.00
07/10/17	2016-054.12	2MFD, Aerobic Digester Tank 6" Thimble page 28; Water Line- A 12" page 28; 8" Sewer Line between SMH 7 and SMH 8 page 27; 6" Waste Activated Sludge pipe*	\$ 1,200.00	\$ 1,380.00	\$ 83,835.00	\$18,883.00
07/14/17	2016-054.12	2MFD, Dewatering Centrifuge-Drilled Pier; Sewer Line between SMH 7 and SMH 8; s 1,200.00 Aerobic Digester Tank 1 6" pipe thimble; Dewatering Centrifuge base course and top	\$ 1,200.00	\$ 1,380.00	\$ 85,215.00	\$17,503.00
07/18/17	2016-054.12	2MFD, Aerobic Digester-Drilled Pier- Horizontal check; Sewer line between SMH 8 and SMH 9; Dewatering Centrifuge Top of base course (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 86,595.00	\$16,123.00
08/08/17	2016-054.13	2MFD, Deawtering Centrifuge Building drilled pier foundation layout; Hyundai Water Valve Vault (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 87,975.00	\$14,743.00
08/25/17	2016-054.13	2MHD, Check and verify locatin of four corners of building frame work of Dewatering Centrifuge; Check elevation 32.50 around frame work of Dewatering Centrifuge	\$ 900.00	\$ 1,035.00	\$ 89,010.00	\$13,708.00
09/07/17	2016-054.14	2MFD, Aerobic Digester Drilled Pier, 1-20,27,33,39; Aerobic Digester Tank 2 6" Pipe Thimble; Headworks- top of footing; Headworks- Weir Wall, Flow Channel 2 and	\$ 1,200.00	\$ 1,380.00	\$ 90,390.00	\$12,328.00
09/15/17	2016-054.14	2 MFD, Check elevation for finish grade of Tipalao Effluent Valve Pit; Check elevation of Oxidation Ditch Supply Pipe 30"; Locate & check elevation of end section for Pipe	\$ 1,200.00	\$ 1,380.00	\$ 91,770.00	\$10,948.00
09/18/17	2016-054.14	2MFD, Fire Hydrant at Sta. 7+82.21; 30" Oxidation Ditch Supply Line; Aerobic Digester 8" riser pipe (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 93,150.00	\$9,568.00
09/25/17	2016-054.14	2MHD, As-built of Administration Building drilled pier foundation; Sewer line between sewer manhole 1 and sewer manhole 2 (Ed, Allan)	\$ 900.00	\$ 1,035.00	\$ 94,185.00	\$8,533.00
09/27/17	2016-054.14	2MFD, Check horizontal location of Administration Building drilled pier foundation; Check horizontal and vertical location of Digester 1 OVF-DIP 6" Pipe (Darius, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 95,565.00	\$7,153.00
10/02/17	2016-054.15	3MFD, Layout of Hyundai water line from Sta. 16+51.44 to Sta. 24+11.88, Work completed: Sta. 16+51.44 to Sta. 24+11.88 (Ed, Allan, Stephen)	\$ 1,200.00	\$ 1,380.00	\$ 96,945.00	\$5,773.00
10/04/17	2016-054.15	3MFD, Layout of stations for Hyundai water line from Sta. 16+51.44 to Sta. 24+11.88, Work completed: Sta. 16+51.44 to Sta. 22+04.71 and Sta. 23+25.56	\$ 900.00	\$ 1,035.00	\$ 97,980.00	\$4,738.00
10/05/17	2016-054.15	3MFD, Layout of station for Hyundai water line from Sta. 16+51.44 to Sta. 24+01.44, Work completed (Ed, Aaron, Stephen)	\$ 900.00	\$ 1,035.00	\$ 99,015.00	\$3,703.00
10/06/17	2016-054.15	2MFD, As-built of portion of Administration Building - drilled pier, As-built of portion of Aerobic Digester-drilled pier, Work completed (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 100,395.00	\$2,323.00
10/19/17	2016-054.15	2MFD, As-built of 6" perforated drain pipe at Headworks; As-built of reflected ceiling plan - Mezzanine of Dewatering Centrifuge	\$ 900.00	\$ 1,035.00	\$ 101,430.00	\$1,288.00
11/07/17	2016-054.15	2MFD, Aerobic Digester Blower Digester Bldg. Base Course, Headworks Channel Weir Slab; RAS/WAS Flow Meter MH-Top of form work; End of trapezoidal concrete	\$ 1,200.00	\$ 1,380.00	\$ 102,810.00	-\$92.00
11/20/17	2016-054.15	2MFD, Invert elevation of sewer manhole no. 7, 8, 9 and 10 (Ed, Allan)	\$ 1,200.00	\$ 1,380.00	\$ 104,190.00	-\$1,472.00
11/27/17	2016-054.15	2MFD, Sewer line at SMH10 resurvey; Aerobic Digester Sludge thickening pipe 6"; Aerobic Digester-6" pipe thimble; Yard piping force main; process drain, lift station	\$ 1,200.00	\$ 1,380.00	\$ 105,570.00	-\$2,852.00

**EXHIBIT B - WORK ZONE CAMERA INVOICES**







Work Zone Cam, LLC.

Invoice

Date	Page
Mar 10, 2017	1
Invoice Number	
ZC0306175169	

650 E. Crescent Avenue  
Upper Saddle River, NJ, 07458  
www.workzonecam.com

# WORK ZONE CAM

**Phone:** (201) 488-1111  
**Fax:** (201) 488-1119

**Sold To:**

Mark Pachkoski  
GHD Guam  
865 S Marine Corps Dr  
Suite 202B '96931  
GU

**Ship To:**

Mark Pachkoski  
GHD Guam  
865 S Marine Corps Dr  
Suite 202B '96931  
GU

Order No. ZC0306175169	Order Date Mar 6, 2017	Customer No. 32539	Salesperson BC	PO Number	Ship Via	Terms NET10
---------------------------	---------------------------	-----------------------	-------------------	-----------	----------	----------------

Qty. Ord.	Qty. Shp.	Item Number	Description	Unit Price	UOM	Extended Price
1.00	1.00	ZCPS02011	Work Zone Cam - 6MP Fully Hosted Service Server: Agat-Santa Rita WWTP Project: Agat-Santa Rita WWTP Location: Suite 202B GU Duration: 04/05/17 - 04/05/18	3,900.00	Ea.	3,900.00

**GHD Inc. - GUA - 14**  
 Vendor \_\_\_\_\_ PO 38000925  
 GL \_\_\_\_\_  
 Project / Phase 11/09000/10  
 Subconsultant Agreement  YN # \_\_\_\_\_  
 Terms: PWP  Other \_\_\_\_\_  
 Date: 04/13/17 Approver: *[Signature]*  
*BRUNO RYEF*  
*John Groom*

<b>ALL PRICING IN U.S. DOLLARS</b>	Tax summary:	Subtotal	3,900.00
	NT 0.00	Total sales tax	0.00
		Total amount Less payment	3,900.00
		Amount due	3,900.00

# WORK ZONE CAM

650 E. Crescent Avenue  
Upper Saddle River, NJ 07458

**Contact:**

Raymond Kuttner  
Senior Accounting Manager  
[rkuttner@earthcam.com](mailto:rkuttner@earthcam.com)  
201-403-2917 Direct  
201-488-1119 Fax

**PLEASE SEND WIRE/ACH PAYMENTS TO:**

**PNC Bank  
141 Franklin Turnpike  
Mahwah, NJ 07430**

**ABA: 031207607**

**ACCOUNT #: 8039896576**

**SWIFT: PNCCUS33**

**EXHIBIT C - SURVEY INVOICES**

# GUAM SURVEYOR, LLC

STREET: 171 CHALAN PALE RAMON HAYA RT. 1 (MARINE DRIVE), YIGO, GUAM 96929  
 MAIL: P.O. Box 6216, TAMUNING, GUAM 96931      WWW.GUAMSURVEYOR.COM  
 P. 671-637-2042 / F. 671-637-2041 M. 688-0184      SURVEYOR@GUAMSURVEYOR.COM

## INVOICE # 2016-054.15 - 11-01-2017

<b>To:</b> Mr. Bryan Ryley, Construction Manager GHD 865 South Marine Corps Drive, Suite 202 Tamuning, Guam 96913 472-6792 / 477-6229 / m: 797-3336 Bryan.Ryley@ghd.com	<b>Project:</b> 2016-054.15 <b>Project Name:</b> GWA Agat-Santa Rita WWTP Replacement Project <b>Village:</b> Agat-Santa Rita <b>State:</b> Guam <b>Type of Survey:</b> Construction Quality Assurance Survey <b>Project Status:</b> Completed <b>Finan. Stat:</b> Unpaid <b>Date of Invoice:</b> 11/01/2017
--	---

Proj. #	Date:	Task	Survey description	Amount
2016-054.15	10/2/2017	87	3MFD, Layout of Hyundai water line from Sta 16+ 51.44 to Sta. 24+ 11.88; Work completed: Sta. 16+ 51.44 to Sta 24+ 11.88 (Ed, Allan, Stephen)	\$ 1,200.00
2016-054.15	10/4/2017	88	3MHD, Layout of stations for Hyundai water line from Station 16 + 51.44 to Station 24 + 11.88; Work completed: Stations 16 + 51.44 to 22 + 04.71 and Stations 23 + 25.56	\$ 900.00
2016-054.15	10/5/2017	89	3MHD, Layout of station for Hyundai water line from Station 16 + 51.44 to Station 24 + 01.44; Work completed (Ed, Aaron, Stephen)	\$ 900.00
2016-054.15	10/16/2017	90	2MFD, As-built of portion of Administration Building- drilled pier; As-built of portion of Aerobic Digester- drilled pier; Work completed (Ed, Allan)	\$ 1,200.00
2016-054.15	10/19/2017	91	2MHD, As-built of 6" perforated drain pipe at Headworks; As-built of reflected ceiling plan- Mezzanine of Dewatering Centrifuge	\$ 900.00

**GHD Inc. - GUA - 14**  
 Vendor 380 GU SURV PO 380000407  
 GL 5710080  
 Project / Phase 11109000/09  
 Subconsultant Argement? Y/N #  
 Terms: PWP  Other  
 Date: 11/03/17 Approver: [Signature]  
[Signature] BRYAN T. RYLEY  
[Signature] PAUL K. BARON

**\*Total due this invoice: \$ 5,100.00**

**NOTE: All invoices are due upon receipt. To ensure proper credit, please indicate project number and lot name (or project name) on your payment. If paying by check, make check payable to Guam Surveyor, LLC. For your convenience, we also accept credit card payments on our website at <http://www.guamsurveyor.com>. If you need help with paying by credit card, instructions are online at <http://www.youtube.com/watch?v=h7D4E6Ptt0A> or you can give us a call at 671-637-2042 or 671-688-9868.**

By: [Signature]  
 Name: Dennis S. Balagtas, P.L.S. No. 75

This Phase 09 invoice carried over from 2017 invoice

**EXHIBIT D - EARTHCAM INVOICES**

**Bryan Ryley**  
 GHD Guam  
 865 S Marine Corps Dr Suite 202  
 Tamuning, Guam 96913

**Ship to: Bryan Ryley**  
 GHD Guam  
 865 S Marine Corps Dr Suite 202  
 Tamuning, Guam 96913

671 472-6792  
 671 797-3336 (Mobile)  
 bryan.ryley@ghd.com

671 472-6792  
 bryan.ryley@ghd.com

Invoice Date: February 12, 2018  
 Payment Terms:  
 NET 30

**Make all checks payable to EarthCam Inc.**  
 650 East Crescent Avenue, Upper Saddle River, NJ 07458

\* Please include your client ID on your check: 32539

MANAGED SERVICES	Quantity	Price	Total
<b>Platinum Service</b> <i>Agat-Santa Rita WWTP PTZ / Agat-Santa Rita WWTP PTZ [03/09/18 - 03/09/19]</i> <i>Tamuning GU</i>	(1 year) 1	\$6900	\$6900
<b>Robotic Camera Software Support Package</b> <i>Agat-Santa Rita WWTP PTZ / Agat-Santa Rita WWTP PTZ [03/09/18 - 03/09/19]</i> <i>Tamuning GU</i>	(1 year) 1		\$0

**Thank you for choosing EarthCam!**  
 We appreciate your purchase and look forward  
 to supporting your project needs.

**Amount Due \$6,900**

Our Accounting Department:  
[Raymond Kuttner \(201\) 403-2917](mailto:rkuttner@earthcam.com)  
[rkuttner@earthcam.com](mailto:rkuttner@earthcam.com)

\*Date Generated: 02/12/18. This invoice is confidential. All prices are quoted in US Dollars. While EarthCam, Inc. will endeavor to meet the customer's desired delivery date, no shipment date can be scheduled until after order is accepted by EarthCam, Inc. Payment in full must precede acceptance, which may be made by cash, cleared check, Fed wire, ACH or major credit card. All sales are final. All orders and services are subject to force majeure. All services shall automatically renew for successive one (1) month periods and continue until customer shall provide thirty (30) days written notice of termination to EarthCam, Inc. Any and all liability arising out of products or services included in the order, however or whenever arising, shall not, under any and all circumstances, exceed the actual payments received by EarthCam, Inc. in connection therewith or one month's service fee, whichever is less. In no event shall EarthCam, Inc. be liable for any special, incidental or consequential damages. Lifetime camera warranty for active software subscribers. Additional parts covered under standard 1 year manufacturer warranty.





# -INVOICE-

Invoice Number:  
WS0825165158

Bryan Ryley  
GHD Guam  
865 S Marine Corps Dr Suite 202  
Tamuning, Guam 96931

Ship to: Bryan Ryley  
GHD Guam  
865 S Marine Corps Dr Suite 202  
Tamuning, Guam 96931

671 472-6792  
671 797-3336 (Mobile)  
bryan.ryley@ghd.com

671 472-6792  
bryan.ryley@ghd.com

Invoice Date: August 25, 2016  
Purchase Order: TBA  
Payment Terms:  
PREPAY

Make all checks payable to EarthCam Inc.  
650 East Crescent Avenue, Upper Saddle River, NJ 07458

CAMERA SYSTEMS	Quantity	Price	Total
Mobile TrailerCam Lite	1	\$24,995	\$24,995
Mobile Trailer Handling	1	\$750	\$750
<b>MANAGED SERVICES</b>			
Platinum Service <i>Archive every 5 minutes</i>	(1 year) 1	\$6,900	\$6,900
Robotic Camera Software Support Package <i>(TrailerCam Lite)</i>	(1 year) 1		Included
EarthCam Consulting Services	1		Included

Thank you for choosing EarthCam!  
We appreciate your purchase and look forward  
to supporting your project needs.

Amount Due **\$32,645**

Our Accounting Department:  
Raymond Kuttner (201) 403-2917  
rkuttner@earthcam.com

GHD Inc. - GUA - 14  
Vendor 280ecr PO \_\_\_\_\_  
GL \_\_\_\_\_  
Project / Phase 11109000 / 10  
Subconsultant Argement? Y N # \_\_\_\_\_  
Terms: PWP  Other \_\_\_\_\_  
Date: 9/28/16 Approver: Jeff G. Gooen  
Jeff Gooen

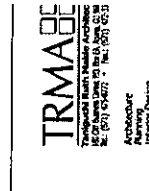
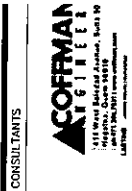
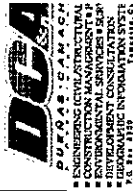
Notes

Shipping FOB Upper Saddle River, NJ  
GHD Guam Can Provide Freight Forwarder - \$750 Handling Fee Will Apply

\*Date Generated: 08/25/16. This invoice is confidential. All prices are quoted in US Dollars. While EarthCam, Inc. will endeavor to meet the customer's desired delivery date, no shipment date can be scheduled until after order is accepted by EarthCam, Inc. Payment in full must precede acceptance, which may be made by cash, cleared check, Fed wire, ACH or major credit card. All sales are final. All orders and services are subject to force majeure. All services shall automatically renew for successive one (1) month periods and continue until customer shall provide thirty (30) days written notice of termination to EarthCam, Inc. Any and all liability arising out of products or services included in the order, however or whenever arising, shall not, under any and all circumstances, exceed the actual payments received by EarthCam, Inc. in connection therewith or one month's service fee, whichever is less. In no event shall EarthCam, Inc. be liable for any special, incidental or consequential damages. Lifetime camera warranty for active software subscribers. Additional parts covered under standard 1 year manufacturer warranty.

**EXHIBIT E - BAZA GARDENS SANITARY  
SEWER DOCUMENTS**





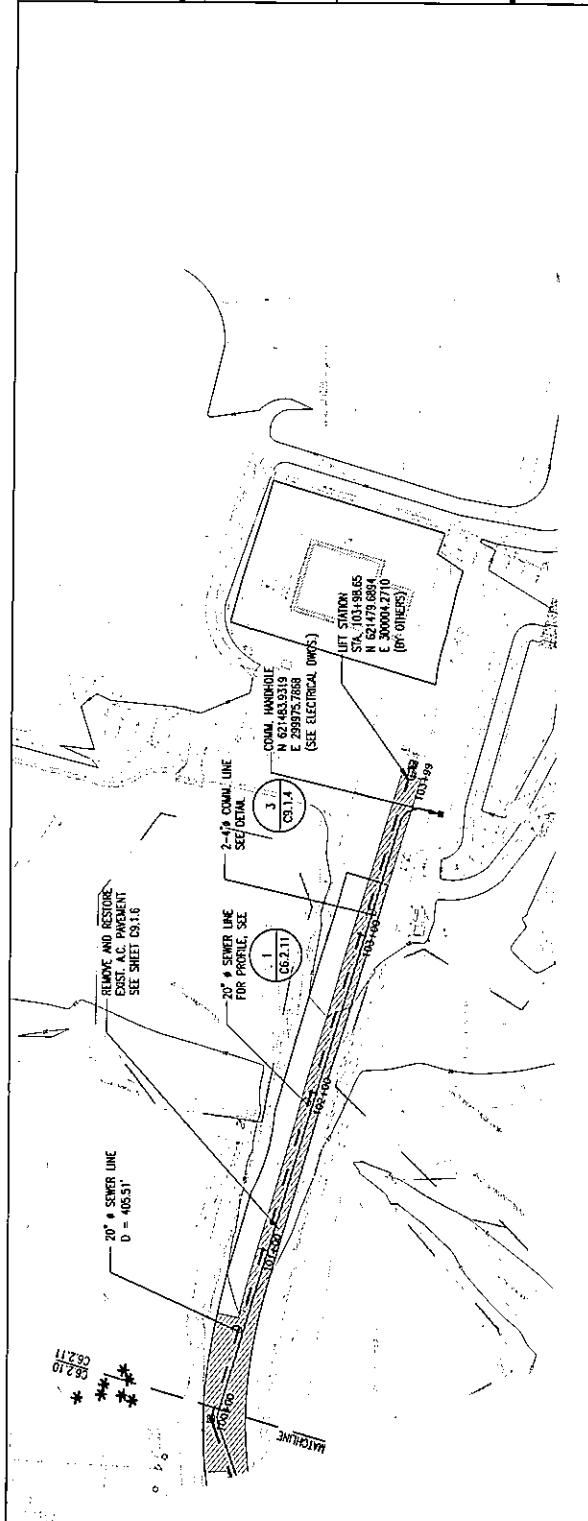
PROJECT TITLE  
 GULM WATERWORKS AUTH  
 BAZA GARDENS  
 WASTEWATER  
 CROSS-ISLAND PUMI  
 AND  
 CONVEYANCE SYST  
 (PHASE-1)  
 BID SET

Name	Date	Description
Project No.:		GG151405
CD No.:		GG1508-C6-2-11-D
Issue Date:		SEPTEMBER 6, 21
Drawn By:		JMCR/DJP
Checked By:		JMC/GMS
Suppl. By:		EM/SAR
Sheet Title:		

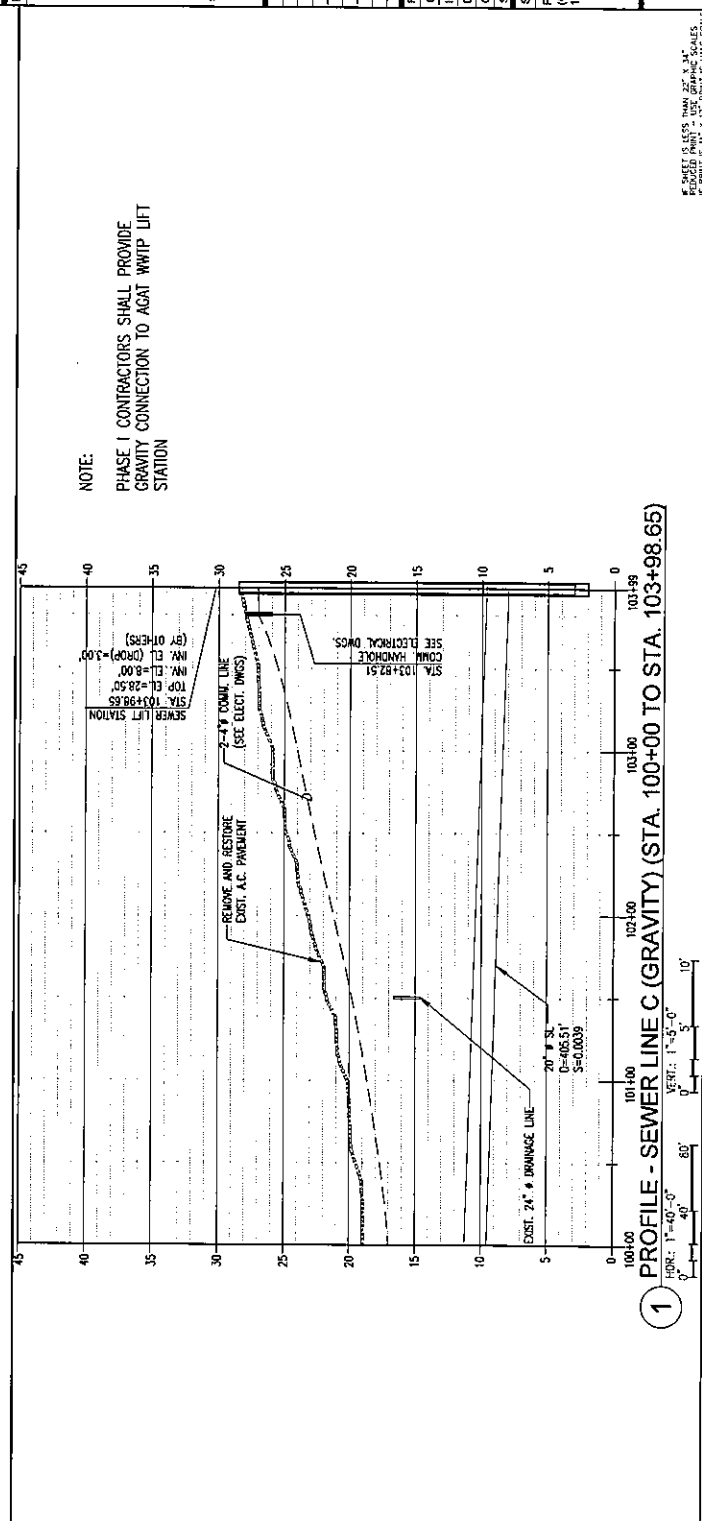
PROFILE & PLAN - SEWER LINE C  
 (GRAVITY) (STA. 100+00 TO STA. 103+98.65)

C6.2.11  
 Sheet 33 of 11

THIS SHEET IS LESS THAN 24" X 36".  
 SHOULD PRINT AT USE GRAPHIC SCALES.  
 FEDERAL BUREAU OF SURVEYING

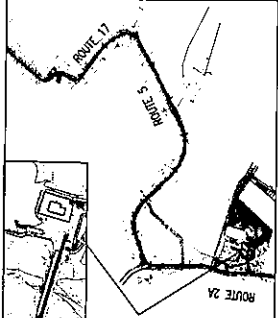


2 PLAN - SEWER LINE C (GRAVITY) (STA. 100+00 TO STA. 103+98.65)



1 PROFILE - SEWER LINE C (GRAVITY) (STA. 100+00 TO STA. 103+98.65)

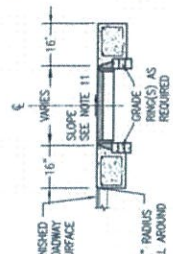
NOTE:  
 PHASE 1 CONTRACTORS SHALL PROVIDE  
 GRAVITY CONNECTION TO AGAT WHIP LIFT  
 STATION



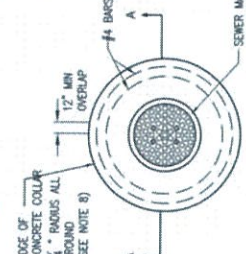
KEY PLAN  
 NOT TO SCALE

**MANHOLE COVER NOTES:**

- TRAFFIC STRENGTH MANHOLE FRAME & COVER SHALL COMPLY WITH MS108 WITH WHEEL LOADS EQUIVALENT MANHOLE FRAMES & COVERS OTHER THAN SHOWN MAY BE USED UPON APPROVAL BY THE ENGINEER.
- THE FRAME SEAT AND COVER EDGE SHALL BE MACHINED TO A TRUE BEARING SURFACE ALL AROUND.
- THE SURFACE SHOWN IS FOR ILLUSTRATION ONLY. ANY SURFACE DESIGN, OTHER THAN SMOOTH, MAY BE USED UPON APPROVAL.
- FRAMES & COVERS SHALL CONFORM TO ASTM A48, CLASS 40 FOR GRAY IRON CASTINGS.
- A CAST-IN-PLACE CONCRETE COLLAR SHALL BE PLACED AROUND A MANHOLE FRAME UNLESS OTHERWISE DIRECTED.
- MANHOLE COVER SHALL BEAR NAME OF OWNER & SYSTEM FUNCTION (IF APPLICABLE).
- CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF MINOR CONCRETE STRUCTURE.
- CONCRETE COLLARS MAY BE POURED ROUND, OR ANY OTHER APPROPRIATE SHAPE WHEN APPROVED BY THE ENGINEER.
- COMMERCIAL PREFABRICATED GRADE RINGS FOR MANHOLES SHALL CONFORM TO AOSTM M 199 (ASTM C-476).
- MANHOLE COVER & FRAME SHOWN. OTHER SHAPES MAY APPLY TO UTILITY AND VALVE COVERS AND FRAMES.
- THE SLOPE OF THE MANHOLE COVER AND COLLAR SHALL MATCH THE ROADWAY PROFILE AND CROSS-SLOPE.



**7B SECTION**  
 NOT TO SCALE

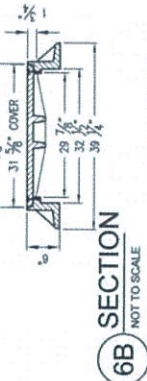


**7A PLAN**  
 NOT TO SCALE

**7 CONCRETE COLLAR DETAILS**  
 NOT TO SCALE

**SEWER MANHOLE RING AND COVER NOTES:**

- MANHOLE RING AND COVER SHALL BE 30"x6" LOCKING TYPE WITH H-20 TRAFFIC MARKING.
- LOCKING COVER SHALL BE USED AT ALL LOCATIONS. THE COVER SHALL BE LOCKED DOWN WITH THREE 5/8" STAINLESS STEEL ALLEN HEAD BOLTS.
- ALL CASTINGS SHALL HAVE A BRITNISHCASTING COATING.
- RING AND COVER SHALL BE TESTED FOR ACCURACY OF FIT AND MARKED IN SETS FOR DELIVERY.
- RING AND COVER SHALL BE OLIMPIC FOUNDRY PART NO. W169 D/T OR APPROVED EQUAL.

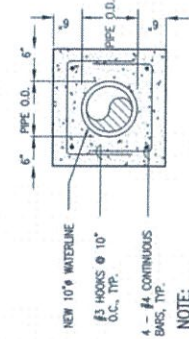


**6B SECTION**  
 NOT TO SCALE



**6A PLAN**  
 NOT TO SCALE

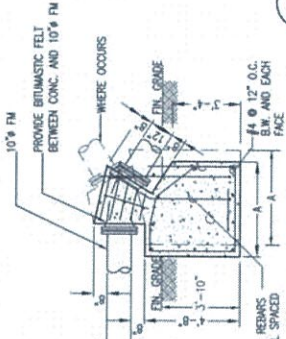
**6 SEWER MANHOLE RING AND COVER**  
 NOT TO SCALE



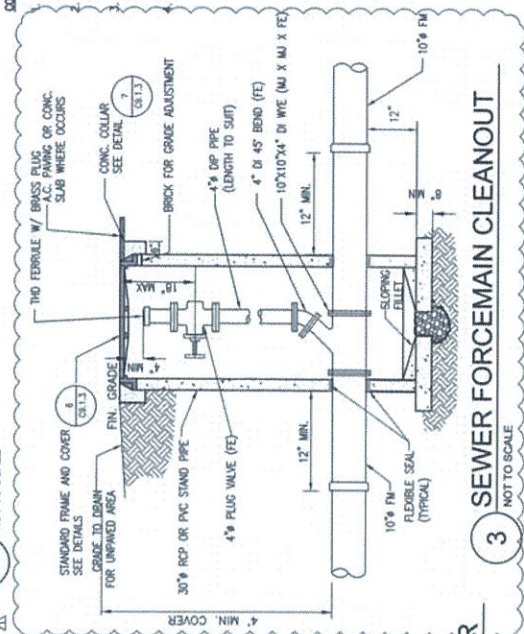
**NOTE:**  
 EXTEND CONC. JACKET 10 FT ON BOTH SIDES OF PIPE CROSSING.

**5 CONCRETE PIPE JACKET DETAIL**  
 NOT TO SCALE

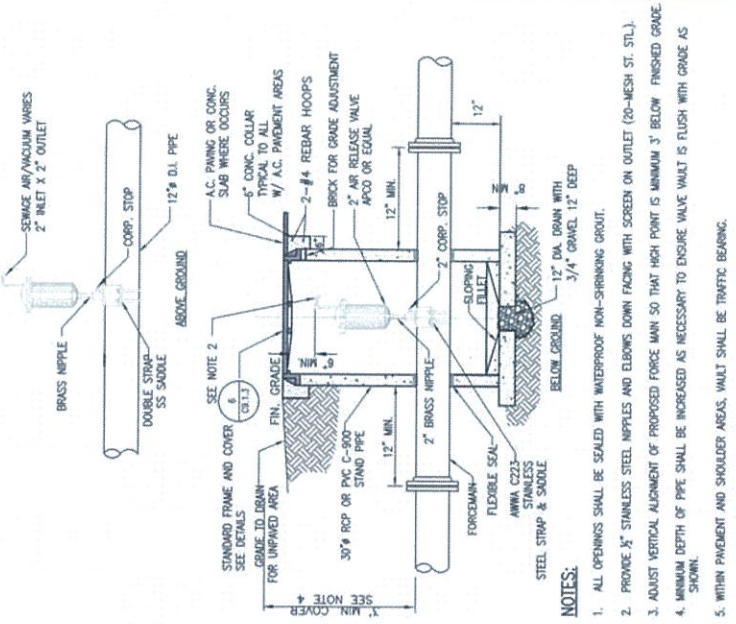
DEFLECTION	H	A	B
45° BEND	4'-8"	7'-4"	9'-0"
22.5° BEND	4'-8"	6'-0"	6'-0"
11.25° BEND	4'-8"	5'-0"	4'-0"
1" TO 5" MAX.	4'-8"	4'-0"	3'-0"



**4 VERTICAL THRUST BLOCK DETAIL**  
 NOT TO SCALE



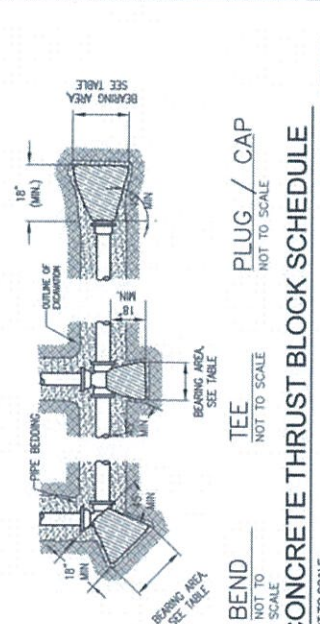
**3 SEWER FORCEMAIN CLEANOUT**  
 NOT TO SCALE



**2\"/>
 NOT TO SCALE**

**CONCRETE THRUST BLOCK SCHEDULE**

FITTINGS	BEARING AREA (SQ. FT.)
6\"/>	4,500
8\"/>	7,500
10\"/>	9,000
12\"/>	15,000
1/4 (90°) BEND	2,500
1/8 (45°) BEND	4,000
1/8 (22.5°) BEND	1,500
1/32 (11.25°) BEND	2,500
TEE / GATE VALVE / PLUG	3,000
	5,250
	7,750
	11,000



**1 CONCRETE THRUST BLOCK SCHEDULE**  
 NOT TO SCALE

12-01-16 (REVISION-1)  
 DATE: 12-01-16  
 PROJECT NO.: G015-06  
 CAD DWP FILE: G01506-C08.1.3.DW  
 ISSUE DATE: DECEMBER 01, 20  
 DRAWN BY: JMC/HJ/CP  
 CHECKED BY: JMC/EMS  
 SUPERVISED BY: EMS/AVE  
 SHEET TITLE: SEWER DETAILS



SECTION 330130.13 - SEWER AND MANHOLE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing of Gravity Sewer Piping:
  - a. Low pressure air testing.
  - b. Exfiltration testing.
  - c. Infiltration testing.
2. Testing of pressure piping.
3. Deflection testing of plastic sewer piping.
4. Testing of Manholes:
  - a. Vacuum testing.
  - b. Exfiltration testing.

B. Related Requirements:

1. Section 333400 - Sanitary Utility Sewerage Force Mains: Pipe materials and accessories normally encountered with municipal sanitary sewage force mains.

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
2. ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.

B. American Water Works Association:

1. AWWA C600 - Installation of Ductile Iron Mains and Their Appurtenances.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submit following items prior to start of testing:

1. Testing procedures.
2. List of test equipment.
3. Testing sequence schedule.

4. Provisions for disposal of flushing and test water.
5. Certification of test gage calibration.
6. Deflection mandrel drawings and calculations.

C. Test and Evaluation Reports: Indicate results of manhole and piping tests.

## PART 2 - PRODUCTS

### 2.1 VACUUM TESTING

#### A. Equipment:

1. Vacuum pump.
2. Vacuum line.
3. Vacuum Tester Base:
  - a. Compression band seal.
  - b. Outlet port.
4. Shutoff valve.
5. Stopwatch.
6. Plugs.
7. Vacuum Gage: Calibrated to 0.1 in. Hg

### 2.2 EXFILTRATION TESTING

#### A. Equipment:

1. Plugs.
2. Pump.
3. Measuring device.

### 2.3 AIR TESTING

#### A. Equipment:

1. Air compressor.
2. Air supply line.
3. Shutoff valves.
4. Pressure regulator.
5. Pressure relief valve.
6. Stopwatch.
7. Plugs.
8. Pressure Gage: Calibrated to 0.1 psi



2.4 INFILTRATION TESTING

- A. Equipment: Weirs.

2.5 HYDROSTATIC TESTING

- A. Equipment:

1. Hydro pump.
2. Pressure hose.
3. Water meter.
4. Test connections.
5. Pressure relief valve.
6. Pressure Gage: Calibrated to 0.1 psi (0.69 kPa).

2.6 DEFLECTION TESTING

- A. Equipment:

1. "Go, no go" mandrels.
2. Pull/retrieval ropes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that manholes and piping are ready for testing.
- C. Verify that trenches are backfilled.
- D. Verify that pressure piping thrust restraint system is installed.

3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for preparation.
- B. Lamping:
  1. Lamp gravity piping after flushing and cleaning.
  2. Perform lamping operation by shining light at one end of each pipe section between manholes.
  3. Observe light at other end.
  4. Pipe not installed with uniform line and grade will be rejected.
  5. Remove and reinstall rejected pipe sections.

6. Reclean and lamp until pipe section is installed to uniform line and grade.
- C. Plugs:
1. Plug outlets, wye branches, and laterals.
  2. Brace plugs to resist test pressures.
- 3.3 FIELD QUALITY CONTROL
- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Low-Pressure Air Testing:
1. Test each reach of gravity sewer piping between manholes.
  2. Introduce air pressure slowly to approximately 4
  3. Determine ground water elevation above spring line of piping.
  4. For every foot of ground water above spring line of piping, increase starting air test pressure by 0.43 psi
  5. Do not increase pressure above 10 psig
  6. Allow pressure to stabilize for at least five minutes.
  7. Adjust pressure to 3.5 psig or to increased test pressure as determined above when ground water is present.
  8. Do not make allowance for laterals.
  9. Minimum Testing Duration in Minutes per 100 feet
    - a. Pipe Size 10 Inches : 1.5.
    - b. Pipe Size 12 Inches : 1.8.
    - c. .
  10. Record drop in pressure during testing period.
  11. If air pressure drops more than 1.0 psi during testing period, piping has failed.
  12. If 1.0 psi air pressure drop has not occurred during testing period, piping is acceptable; discontinue testing.
  13. If piping fails, test reach of piping in incremental stages until leaks are isolated, repair leaks, and retest entire reach between manholes.
- C. Testing of Pressure Piping:
1. Test system according to AWWA C600 and following:
    - a. Hydrostatically test each portion of pressure piping, including valved section, at 1.5 times working pressure of piping, based on elevation of lowest point in piping corrected to elevation of test gage.
    - b. Conduct hydrostatic testing for at least two hours.
    - c. Slowly fill with water portion of piping to be tested, expelling air from piping at high points.
    - d. Install corporation cocks at high points.
    - e. Close air vents and corporation cocks after air is expelled.
    - f. Raise pressure to specified test pressure.
    - g. Observe joints, fittings, and valves undergoing testing.

- h. Remove and renew cracked pipes, joints, fittings, and valves that show visible leakage.
- i. Retest.
- j. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
- k. Maintain pressure within plus or minus 5.0 psi of test pressure.
- l. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of testing.
- m. Compute maximum allowable leakage using following formula:
  - 1)  $L = [SD \times \text{sqrt}(P)]/C$ .
  - 2) L = testing allowance, gph
  - 3) S = length of pipe tested, feet
  - 4) D = nominal diameter of pipe, inches
  - 5) P = average test pressure during hydrostatic testing,.
  - 6) C = 148,000
  - 7) If pipe undergoing testing contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each pipe size.

2. If testing of piping indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within acceptable limits.
3. Correct visible leaks regardless of quantity of leakage.

D. Deflection Testing of Plastic Sewer Piping:

1. Perform vertical ring deflection testing on PVC and acrylonitrile butadiene styrene sewer piping after backfilling has been in place for at least 30 days but not longer than 12 months.
2. Allowable maximum deflection for installed plastic sewer pipe is no greater than five percent of original vertical internal diameter.
3. Perform deflection testing using properly sized rigid ball or "go, no go" mandrel.
4. Furnish rigid ball or mandrel with diameter not less than 95 percent of base or average inside diameter of pipe, as determined by ASTM standard to which pipe is manufactured; measure pipe diameter in compliance with ASTM D2122.
5. Perform testing without mechanical pulling devices.
6. Locate, excavate, replace, and retest piping that exceeds allowable deflection.

E. Manhole Testing:

1. If air testing, test whenever possible prior to backfilling in order to more easily locate leaks.
2. Repair both outside and inside of joint to ensure permanent seal.
3. Test manholes with manhole frame set in place.
4. Vacuum Testing:
  - a. Comply with ASTM C1244
  - b. Plug pipe openings; securely brace plugs and pipe.
  - c. Inflate compression band to create seal between vacuum base and structure.
  - d. Connect vacuum pump to outlet port with valve open, then draw vacuum to 10 in. Hg
  - e. Close valve.

- f. Manhole Test Duration in Seconds:
    - 1) Diameter 4 Feet :60.
  - g. Record vacuum drop during test period.
  - h. If vacuum drop is greater than 1 in. Hg during testing period, repair and retest manhole.
  - i. If vacuum drop of 1 in. Hg does not occur during test period, manhole is acceptable; discontinue testing.
  - j. If vacuum test fails to meet 1 in. Hg drop in specified time after repair, repair and retest manhole.
- 5. If unsatisfactory testing results are achieved, repair manhole and retest until result meets criteria.
  - 6. Repair visible leaks regardless of quantity of leakage.

END OF SECTION 330130.13

## SECTION 330513 - MANHOLES AND STRUCTURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Cast-in-place concrete manholes and structures with transition to cover frame, covers, anchorage, and accessories.
2. Modular precast concrete manholes and structures with tongue-and-groove joints and transition to cover frame, covers, anchorage, and accessories.
3. Masonry manhole and structure sections with masonry transition to cover frame, covers, anchorage, and accessories.
4. Doghouse manhole connections to existing sewer lines.
5. Bedding and cover materials.
6. Pile support systems.

##### B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Erection and bracing of forms.
2. Section 032000 - Concrete Reinforcing: Execution requirements for reinforcing steel as required by this Section.
3. Section 033000 - Cast-in-Place Concrete: Concrete type for manhole and structure foundation slab construction.
4. Section 040514 - Masonry Mortaring and Grouting: Mortar and grout.
5. Section 042000 - Unit Masonry: Product requirements for clay brick units for use in manhole and structure construction.
6. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
7. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
8. Section 312316 - Excavation: Excavating for manholes, structures, and foundation slabs.
9. Section 312323 - Fill: Backfilling after manhole and structure installation.
10. Section 330130.13 - Sewer and Manhole Testing: Testing requirements for manholes.

#### 1.2 REFERENCE STANDARDS

##### A. American Association of State Highway Transportation Officials:

1. AASHTO M91 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
2. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
3. AASHTO M306 - Standard Specification for Drainage, Sewer, Utility, and Related Castings.

##### B. American Concrete Institute:

1. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.

C. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale).
4. ASTM C55 - Standard Specification for Concrete Building Brick.
5. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
6. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
8. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
9. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for manhole covers, component construction, features, configuration, dimensions
- C. Shop Drawings:
  1. Indicate structure locations and elevations.
  2. Indicate sizes and elevations of piping and penetrations
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements
- E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Qualifications Statements:

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Comply with precast concrete manufacturer's instructions and ASTM C913 for unloading, storing, and moving precast manholes and drainage structures.

D. Storage:

1. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
2. Repair property damaged from materials storage.

PART 2 - PRODUCTS

2.1 MANHOLES AND STRUCTURES

A. Standard Precast Concrete Manholes:

1. Description: ASTM C 478 precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990 bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923 cast or fitted into manhole walls, for each pipe connection.

B. High Velocity Protection

1. Each manhole and force-main receiving structure shall be coated with an epoxy based liner to protect against high velocities and corrosion. The entire structure from the bottom to the top including rungs, rings and channel shall be coated. The coating shall be applied after the concrete in the structures has completely cured. Acceptable coating manufactures include:
  - a. Raven Lining systems
  - b. Sika
  - c. Approved Equal

C. Manhole Frames and Covers:

1. Description: Ferrous; 30-inch ID by 6- to 9-inch riser, with 4-inch- minimum- width flange and 31-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 48, Class 40 gray iron unless otherwise indicated.

## 2.2 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R and the following:
1. Cement: ASTM C 150, Type II or JIS R5210.
  2. Fine Aggregate: ASTM C 33, sand.
  3. Coarse Aggregate: ASTM C 33, crushed gravel.
  4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
    - a. Invert Slope: 1 percent through manhole.
  2. Benches: Concrete, sloped to drain into channel.
    - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
  2. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

## 2.3 FRAMES AND COVERS

- A. Description:
1. Construction: ASTM, Class 30B, cast iron.
  2. Lid:
    - a. Machined flat bearing surface.
    - b. Removable.
  3. Cover Design: Closed



4. Live Load Rating: H20-44
5. Sealing gasket.

## 2.4 RISER RINGS

### A. Riser Rings:

1. 4 Inches to 6 Inches Thick:
  - a. Material: Precast concrete.
  - b. Comply with ASTM C478
2. Less than 4 Inches Thick:
  - a. Material: Cast iron.
  - b. Comply with AASHTO M306.
3. Rubber Seal Wraps:
  - a. Wraps and Band Widths: Conform to ASTM C877 Type III.
  - b. Cone/Riser Ring Joint: Minimum 3 inches overlap.
  - c. Frame/Riser Ring Joint: 2 inches overlap.
  - d. Additional Bands: Overlap upper band by 2 inches

### B. Accessories:

1. Joint Sealant: Comply with ASTM C990
2. Bolts:
  - a. Stainless Steel: Comply with ASTM F593.
  - b. Galvanized: Comply with ASTM F1554.

## 2.5 ACCESSORIES

### A. Foundation Slab:

1. Cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete
2. Top Surface: Level. Indicate type of anchorage required to anchor to other structural elements.

### B. Concrete: As specified in Section 033000 - Cast-in-Place Concrete

### C. Grout: As specified in Section 036000 - Grout

### D. Odor Control Polyethylene Manhole Insert:

1. Contractor shall supply odor reducing manhole inserts made from high density Polyethylene Copolymer material that meets ASTM Specification Designation D-1248 Class A, Category 5, Type III. Filter shall make use of non-hazardous, according to the

definition for "health hazard" and "physical hazard" provided in the OSHA Hazard Communication Law (29 CFR Part 1910), activated carbon filter media. Insert shall be manufactured to fit the manhole frame rim upon which the manhole cover rests.

2. Contractor shall supply odor reducing manhole inserts for all manholes located along Sewerline B
3. Manufactures
  - a. Parson Environmental Products
  - b. Simple Solutions Dist
  - c. Approved Equal

## 2.6 FINISHES

### A. Steel Galvanizing:

1. ASTM A123
2. Hot dip galvanize after fabrication.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that items provided by other Sections of Work are properly sized and located.
- C. Verify that built-in items are in proper location and are ready for roughing into Work.
- D. Verify correct size of manhole and structure excavation.

### 3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.
- C. Coordinate placement of inlet and outlet pipe or duct sleeves required by other Sections.
- D. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.

- E. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

### 3.3 INSTALLATION

#### A. Excavation and Backfill:

1. Excavate for manholes and structures as specified in Section 312316 - Excavation and in indicated locations and depths.
2. Provide clearance around sidewalls of manhole or structure for construction operations granular backfill
3. If groundwater is encountered, prevent accumulation of water in excavations; place manhole or structure in dry trench.
4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation, as approved by Architect/Engineer.

#### B. Foundation Slab:

- C. Install manholes and structures supported at proper grade and alignment as indicated on Drawings.

- D. Backfill excavations for manholes and structures as specified in Section 312316 - Excavation and 312323 - Fill.

- E. Form and place manhole or structure cylinder plumb and level, to correct dimensions and elevations.

- F. As Work progresses, build fabricated metal items

- G. Cut and fit for pipe and sleeves

- H. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel

- I. Paint interior with two coats of bituminous interior coating at rate of 120sq. ft. per for each coat.

- J. Set cover frames and covers level to correct elevations without tipping.

#### K. Precast Concrete Manholes and Structures:

1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Set precast structures, bearing firmly and fully on crushed stone bedding, compacted as specified in Section 312316 – Excavation and 312323 - Fill or on other support system as indicated on Drawings.
4. Assembly:

Baza Gardens Wastewater Cross-Island Pumping and  
Conveyance System (Phase-I)

- a. Assemble multi-section manholes and structures by lowering each section into excavation.
  - b. Install rubber gasket joints between precast sections according to manufacturer's recommendations.
  - c. Lower, set level, and firmly position base section before placing additional sections.
5. Remove foreign materials from joint surfaces and verify sealing materials are placed properly.
  6. Maintain alignment between sections by using guide devices affixed to lower section.
  7. Joint sealing materials may be installed on Site or at manufacturer's plant.
  8. Verify that installed manholes meet required alignment and grade.
  9. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
  10. Cut pipe flush with interior of structure.
  11. Shape inverts through manhole as indicated on Drawings.
- L. Cast-in-Place Concrete Manholes and Structures:
1. Prepare crushed stone bedding or other support system as indicated on Drawings to receive base slab as specified for precast structures.
  2. Erect and brace forms against movement as specified in Section 031000 - Concrete Forming and Accessories.
  3. Install reinforcing steel as indicated on Drawings and as specified in Section 032000 - Concrete Reinforcing.
  4. Place and cure concrete as specified in Section 033000 - Cast-in-Place Concrete.
  5. Frames and Covers:
    - a. Set frames using mortar and masonry.
    - b. Install radially laid concrete brick with 1/4 inch thick vertical joints at inside perimeter.
    - c. Lay concrete brick in full bed of mortar and completely fill joints.
    - d. If more than one course of concrete brick is required, stagger vertical joints.
    - e. Set frame and cover 2 inches above finished grade for manholes [and structures] with covers located within unpaved areas, to allow area to be graded away from cover beginning 1 inch below top surface of frame.
- M. Sanitary Manhole Drop Connections:
1. Concrete Encasement: Minimum [2] feet outside of manhole upto top of upstream pipe.
  2. Form channel from pipe drop to sweep into main channel at maximum angle of 30 degrees.
- N. Castings:
1. Set frames using mortar and masonry as indicated on Drawings.
  2. Install radially-laid concrete brick with [1/4] inch thick vertical joints at inside perimeter.
  3. Lay concrete brick in full bed of mortar and completely fill joints.
  4. If more than one course of concrete brick is required, stagger vertical joints.

5. Set frame and cover [2] inches) above finished grade for manholes and other structures with covers located within unpaved areas to allow area to be graded away from cover beginning [1] inch below top surface of frame.

#### 3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Test cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete
- C. Test concrete manhole and structure sections as specified in Section 330130.13 - Sewer and Manhole Testing.
- D. Vertical Adjustment of Existing Manholes and Structures:
  1. If required, adjust top elevation of existing manholes and structures to finished grades as indicated on Drawings.
  2. Frames, Grates, and Covers:
    - a. Carefully remove frames, grates, and covers cleaned of mortar fragments.
    - b. Reset to required elevation according to requirements specified for installation of castings.
  3. Reinforcing Bars:
    - a. Remove concrete without damaging existing vertical reinforcing bars if removal of existing concrete wall is required.
    - b. Clean vertical bars of concrete and bend into new concrete top slab or splice to required vertical reinforcement as indicated on Drawings.
  4. Clean and apply sand-cement bonding compound on existing concrete surfaces to receive cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete

END OF SECTION 330513

SECTION 333113 - PUBLIC SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewerage pipe and fittings.
2. Pipe markers.
3. Connection to existing manholes.
4. Manholes.
5. Wye branches and tees.
6. Sanitary laterals.
7. Bedding and cover materials.

1.2 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings.
2. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
4. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
5. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
6. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
7. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
8. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
9. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
10. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
11. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.

12. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
13. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
14. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
15. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
16. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
17. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
18. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
19. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
20. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
6. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
7. AWWA C153 - Ductile-Iron Compact Fittings.

1.3 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Notify affected utility companies at least 72hours prior to construction.

1.4 PREINSTALLATION MEETINGS

- A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.
- B. Convene minimum 2 weeks prior to commencing Work of this Section.
- C. Attendance Roster: Include affected utility companies and appropriate local officials.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.

Baza Gardens Wastewater Cross-Island Pumping and  
Conveyance System (Phase-I)

- B. Product Data: Submit manufacturer catalog cuts and other information indicating proposed materials, accessories, details, , and construction information.
  - C. Shop Drawings:
    - 1. Indicate layout of sewer system and appurtenances
    - 2. Show size, materials, components of system, and burial depth.
  - D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
  - E. Test and Evaluation Reports: Submit reports indicating field tests made and results obtained.
  - F. Manufacturer Instructions:
    - 1. Indicate special procedures required to install specified products.
  - G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
  - H. Qualifications Statements:
    - 1. Submit qualifications for manufacturer and installer.
    - 2. Submit manufacturer's approval of installer.
- 1.6 CLOSEOUT SUBMITTALS
- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
  - B. Project Record Documents: Record invert elevations and actual locations of pipe runs, connections , manholes and cleanouts.
  - C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
  - D. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 20 years' documented experience.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
  - B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
  - C. Storage:
    - 1. Store materials according to manufacturer instructions.
    - 2. Store valves in shipping containers with labeling in place.



- D. Protection:
  - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  - 2. Block individual and stockpiled pipe lengths to prevent moving.
  - 3. Provide additional protection according to manufacturer instructions.
- E. Deliver and store valves in shipping containers with labeling in place.

## 1.8 EXISTING CONDITIONS

- A. Field Measurements:
  - 1. Verify field measurements prior to fabrication.
  - 2. Indicate field measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 SANITARY SEWERAGE PIPE AND FITTINGS

- A. Ductile-Iron Pipe for use at all fittings and drop structures:
- B. Plastic pipe alternative may be used, refer to plans for details
  - 1. Comply with AWWA C151
  - 2. Minimum Pressure Class: 150
  - 3. End Connections: Bell and spigot
  - 4. Outside Coating:
    - a. Type: Asphaltic coating, minimum 2 mil uniform thickness.
  - 5. Lining:
    - a. Type: Asphaltic sealcoat, minimum [1] mil uniform thickness.
    - b. Comply with AWWA C104.
  - 6. Polyethylene encasement: Comply with AWWA C105.
  - 7. Fittings:
    - a. Material: Ductile iron, Class 50
    - b. Comply with AWWA C110.
    - c. Lining: Cement-mortar lined according to AWWA C104 Seal coat lined and coated with bituminous paint
  - 8. Coating:
    - a. Coat pipe and fittings exposed inside of structures with two coats of bituminous
    - b. As specified in Section 099000 - Painting and Coating.

9. Joints:
  - a. Rubber gasket joint devices.
  - b. Comply with AWWA C111.

C. Plastic Pipe:

1. Material: Polyvinyl chloride (PVC), Schedule 80
2. Comply with ASTM D1785.
3. Inside Nominal Diameter: 12 inches End Connections: Bell and spigot style, with solvent-sealed ends.
4. Fittings:
  - a. Material: PVC.
  - b. Comply with ASTM D2466.
5. Joints:
  - a. Solvent welded with solvent cement conforming to ASTM D2564.
  - b. Comply with ASTM D2855.

D. Plastic Pipe (alternative):

1. Material: Polyvinyl chloride (PVC).
2. Comply with ASTM D3034, SDR-35
3. Inside Nominal Diameter: 12 - 15 inches
4. End Connections: Bell and spigot style, with rubber-ring-sealed gasket joint.
5. Fittings: PVC.
6. Joints:
  - a. Elastomeric gaskets.
  - b. Comply with ASTM F477.

2.2 FLEXIBLE COUPLINGS

A. Description:

1. Resilient chemical-resistant elastomeric polyvinyl chloride (PVC) coupling.
2. Attachment: Two stainless-steel clamps, screws, and housings.

2.3 FLEXIBLE PIPE BOOT FOR MANHOLE PIPE ENTRANCES

A. Description:

1. Material: Ethylene propylene rubber (EPDM).
2. Comply with ASTM C923 (C923M).
3. Attachment: stainless-steel clamp and hardware.

2.4 CONCRETE ENCASEMENT AND CRADLES

A. Concrete:

1. As specified in Section 033000 - Cast-in-Place Concrete.
2. Strength: 4000 psi at 28 days.
3. Finish: Rough troweled.

2.5 MANHOLES

A. Description: As specified in Section 330513.16 - Public Manholes and Structures.

B. Description:

1. As specified in Section 330513.16 - Public Manholes and Structures.
2. Material: Precast concrete.
3. Diameter: 48 inches
4. Frames and Covers: Watertight cast iron.
5. Cover Inscription: SANITARY SEWER

2.6 MIXES

A. Grout: As specified in Section 036000 - Grouting

2.7 FINISHES

A. Galvanizing:

1. Hot-dip galvanize after fabrication.
2. Comply with ASTM A123 (A123M).

2.8 ACCESSORIES

A. Pipe Supports:

1. Metal for pipe support brackets: Galvanized structural steel, thoroughly coated with bituminous paint.

B. Pipe Markers: As specified in Section 330526 - Utility Identification.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

- B. Verify that excavation base is ready to receive Work.
- C. Verify that excavations, dimensions, and elevations are as indicated on Drawings.

### 3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Correct over-excavation with coarse aggregate.
- C. Remove large stones or other hard materials that could damage pipe or impede consistent backfilling or compaction.
- D. Protect and support existing sewer lines, utilities, and appurtenances.
- E. Utilities:
  - 1. Maintain profiles of utilities.
  - 2. Coordinate with other utilities to eliminate interference.
  - 3. Notify Architect/Engineer if crossing conflicts occur.

### 3.3 INSTALLATION

- A. Bedding:
  - 1. Excavate pipe trench as specified in Section 312317 - Trenching.
  - 2. Excavate to lines and grades as indicated on Drawings or as required to accommodate installation of encasement.
  - 3. Dewater excavations to maintain dry conditions and to preserve final grades at bottom of excavation.
  - 4. Provide sheeting and shoring as specified in Section 312317 - Trenching .
  - 5. Placement:
    - a. Place bedding material at trench bottom.
    - b. Level materials in continuous layer not exceeding 6 inches compacted depth.
    - c. Compact to 95 percent of maximum density.
- B. Piping:
  - 1. Install pipe, fittings, and accessories according to ASTM D2321 and seal joints watertight.
  - 2. Lay pipe to slope gradients as indicated on Drawings
  - 3. Maximum Variation from Indicated Slope: [1/8] inch in [10] feet
  - 4. Begin at downstream end and progress upstream.
  - 5. Assemble and handle pipe according to manufacturer's instructions, except as may be modified on Drawings or by Construction Manager.
  - 6. Keep pipe and fittings clean until Work has been completed and accepted by Architect/Engineer.

7. Cap open ends during periods of Work stoppage.
8. Lay bell and spigot pipe with bells upstream.

C. Manholes:

1. Install manholes as specified in Section 330513.16 - Public Manholes and Structures

D. Wye Branches and Tees:

1. Concurrent with pipe-laying operations, install wye branches and pipe tees at locations indicated on Drawings.
2. Use standard fittings of same material and joint type as sewer main.
3. Maintain minimum 5ft separation distance between wye connection and manhole.
4. Use saddle wye or tee with stainless-steel clamps for taps into existing piping.
5. Mount saddles with solvent cement or gasket and secure with metal bands.
6. Lay out holes with template, and cut holes with mechanical cutter.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Request inspection by Construction Manager prior to and immediately after placing bedding.

C. Testing:

1. If tests indicate that Work does not meet specified requirements, remove Work, replace, and retest.
2. Pipe Testing:
  - a. Pressure Test: As specified in Section 330130.13 - Sewer and Manhole Testing.
  - b. Infiltration Test: As specified in Section 330130.13 - Sewer and Manhole Testing
  - c. Deflection Test: As specified in Section 330130.13 - Sewer and Manhole Testing
3. Compaction Testing:
  - a. Comply with ASTM D1557 or ASTM D698 and ASTM D6938.
  - b. Testing Frequency: 1 per 600 linear feet/2,000 sq. ft..

3.5 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 330130.13