



**Stantec Consulting Services Inc.**  
3133 West Frye Road, Suite 300, Chandler, Arizona 85226

April 3, 2020  
File: 204284400

**Attention: Anne Coppola**  
Contract Administrator  
Cochise County Procurement Department  
1415 Melody Lane, Building C  
Bisbee, AZ 85603

Dear Ms. Coppola,

**Reference: Water & Wastewater Feasibility Report Douglas, Arizona, 20-24-BOS-03  
Change Order #1: Water System Hydraulic Model**

Stantec Consulting Services Inc. (Stantec) is pleased to submit this scope of services and fees for a change order to support the Water and Wastewater Feasibility Report in Douglas, Arizona. The following scope of services summarizes our understanding of the requirements for this change order. Stantec will perform work as necessary to prepare a hydraulic model of the Douglas water system(s) and use that model to analyze proposed improvements and future growth to determine infrastructure requirements. The proposal for the feasibility report assumed that the City of Douglas would have hydraulic modeling in place and a current water report. This scope of services is based on the scope of work discussed during the Skype meetings held on March 19 and April 1, 2020. The goals stated by scope of work and during that meeting are summarized as follows:

- Hydraulic Model Data Processing
- Hydraulic Model Construction
- Existing Water System(s) Assessment
- Future Water System(s) Assessment
- Groundwater Resources Investigation
- Documentation in Feasibility Report and Douglas Water System(s) Report

See attached Exhibit A for the Professional Services Agreement for Scope of Work and Exhibit B for the Fee Proposal. Please review and call if you have any questions or concerns.

Regards,

**Stantec Consulting Services Inc.**

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**Change Order 1 – Hydraulic Modeling of Douglas Water System(s)****Professional Services Agreement Scope of Work****Cochise County****Water & Sewer Feasibility Report – Douglas, AZ Port of Entry****Project No. 20-24-BOS-03****SCOPE OF WORK****1. CHANGE ORDER SCOPE**

The scope of this change order is for the creation of hydraulic model of the existing City of Douglas (the City) water system. The hydraulic model analysis will help identify constraints on the existing water system and provide the necessary information to assess the feasibility of expanding the water supply system to serve the future Douglas Port of Entry (POE), existing U.S. Border Patrol complex, Cochise College, the Bisbee-Douglas International Airport (BDIA), and to account for future growth particularly between the City of Douglas and the Douglas Port of Entry.

The deliverable will be a standalone report detailing the hydraulic modeling of the Douglas water distribution system and analysis of expansion to serve the proposed Douglas POE and other institutional as well as future growth along the future access highway between the City of Douglas and the POE.

Overlapping efforts between the Water and Wastewater Feasibility Report and Hydraulic Model have been identified and removed from the scope of tasks within this change order. These efforts are described after the related task and identified with a check mark. This information was assumed to be on hand and will aid in the accuracy and usefulness of the Water and Wastewater Feasibility Report – Douglas, AZ Port of Entry.

**Task 208: Hydraulic Model Data Processing**

Objective: This activity will include analysis of base plans and mapping, system inventory and physical data, existing water demand statistics, growth projections and scenarios, performance data, interviews with City staff, City policies and service provision criteria, and relevant reports as related to preparing a hydraulic model of the water system.

- ✓ Task 201 - Collection of the required water system data and coordination with County and City staff is included in Water and Wastewater Feasibility Report budget and is not included in the following tasks.

**Activity 208.1 - Process Available Digital Mapping**

Stantec will process the current City water distribution system AutoCAD map into a GIS-based product to provide the City water mains, wells, storage reservoirs and approximate elevation data for system components. This process will be checked with available data. All data will eventually reside within the project GIS to provide one consistent spatial data source. This GIS data will be provided electronically to the City of Douglas at the completion of this project.

It is understood that the City AutoCAD drawing may not include some recent water system improvements and that the analysis will include only what is in the current mapping. As agreed with the City on April 2, 2020, smaller three- and four-inch diameter pipes will not be included in the model for efficiency, but their demand will be included at nodes and notes in files will account for these pipes.

This work should occur in the third week of April 2020.

**Activity 208.2 - Process Facility Maps / Data (Wells, Storage, Standpipes, and Pumping)**

Stantec will process data to adequately characterize the key system facilities (groundwater wells, storage reservoirs, and pumps). The ground water well information will include at a minimum the metered operating pumping rate, the operating discharge header pressure, the static discharge header pressure and operating pump curve. The storage reservoirs Top Water Level, Bottom Water Level, storage volume, tank wall material (concrete, steel) and inlet/outlet piping (common inlet/outlet, inlet at top of tank)

Typically, Stantec staff would visit all key system components and sites relevant to the existing water system evaluation effort with City staff. However, it is not anticipated Stantec staff will visit the facilities at this time due to COVID-19 restrictions. Therefore, Stantec will request pictures of all key system components and sites as well as information on equipment located at the sites from Douglas staff.

As noted in our Skype meeting of April 2, 2020, the City will identify if there are any Pressure Reducing Valve installations between the High and Low pressure zones. If so, the City will provide installation details.

This work should be carried out in the third week of April 2020.

**Activity 208.3 - Digitize Available Operational Data**

Stantec will digitize available operational data, create spreadsheets and summarize of relevant observations of the water system and assumptions to be made in the model.

For purposes of the model, the City will provide the total (gallons) and unit system wide water annual average day water demand (gallons per capita per day) for 2014 through 2019 and the total (gallons) and unit maximum day demand (gpcpd) in the period 2014 to 2019.

The City will provide meter / billing data for 2018 and 2019 of the top thirty (30) water connections with the highest annual meter readings in the City and analyze same (example golf course, schools, schools with playing fields, hospital, commercial, gravel pit, industrial, multi residential, etc.). The City will provide to Stantec the location of each of these thirty (30) connections on a water distribution system plan. The data will be used in the hydraulic model. The City will provide reservoir level hourly fluctuation levels for the maximum week demand period 2014 to 2019.

It is anticipated that this data will quantify system demands and trends. In addition, we will analyze available records of systems flows, pressures, fire flows, and other metrics as available. It is understood that recent water meter upgrades have resulted in higher than historical readings and that there is concern with historic well flow meter accuracy.

**Activity 208.4 - Field Testing (Facility Data, System Pressures, and Hydrant Flows)**

The model will be used to understand the City water system pressure under normal non hydrant use situation and then several different scenarios each with one fire hydrant in service at critical locations in the City.

Stantec will design a simple program for Douglas staff to conduct field measurements of system pressure at various fire hydrant locations including individually operating up to about ten (10) fire hydrants to characterize the current performance of the wells, storage reservoirs, pumps, and distribution piping.

Typically, Stantec staff would be present during the field testing to work with City staff. However, Stantec staff will be able to participate at this time due to COVID-19 restrictions. Stantec will provide specific instructions for the field-testing program including forms to collect the field data.

Strategic system pressure, pipe roughness tests, and fire flow measurements will be completed by City staff. It is anticipated that this should take no more than three days of effort. The scope of this field testing will be discussed with City staff in order to ensure staff safety and work priorities. It is not anticipated Stantec staff will attend the field testing due to current travel restrictions.

It is expected that the field work should be carried in the fourth week of April 2020.



### Task 209: Hydraulic Model Construction

Objective: Create a comprehensive and accurate steady-state hydraulic representations (i.e. pressures and flows) of the City of Douglas water distribution system within the computer modeling software.

This should start and be finished in the fourth week of April 2020.

#### Activity 209.1 - Model Construction

Stantec will construct a computerized hydraulic model of the existing system by importing the collected data into the hydraulic model software package. All facilities will be constructed to reflect the physical system as close as possible.

As discussed at the meeting of April 2, 2020 the City will review the hydraulic tie, if any, between the City water system high pressure zone and low pressure zone. The model development will wait for this determination by the City.

Deliverables will include the modeling files and a commentary on the basis of construction. Constructed scenarios will include average day water demand (ADD), maximum day water demand (MDD), MDD plus fire flow at up to six critical condition areas (high fire flows associated with critical infrastructure hospital, city hall, schools, etc.), and peak hour demand (PHD). A night filling demand (NFD) scenario will be created only if it is judged relevant and required in order to quantify the envelope of system operation.

It is noted that the City believes that two (2) additional water wells are needed. For modeling purposes, the possible location and capacity of these wells will have to be directed by the City. The decision on the location and capacity are very important as they shape the modeling outcome.

#### Activity 209.2 - Generation and Allocation of Water Demands

Stantec will use the calculated total maximum day system demand in the period 2014 to 2019 along with point or area methods to accurately assess water demands which accrue to each water model node.

Water meter data will be input for the top thirty (30) significant water users within the City including the hospital, golf course, material pit, industrial, and schools. Simulating water quality and transient conditions (extended period simulations and / or water hammer) within the distribution system will not be done.

Aerial photographs and parcel / land use maps will be used to allocate water demands. The water use data for modeling purposes, particularly single family homes, connected to the City water distribution system will be estimated based on the City supplied historic annual maximum day unit system water demand (gallons per capita per day) and the City supplied census/planning data of the number of people per dwelling unit.

#### Activity 209.3 - Model Calibration

Stantec will calibrate the existing system model using the field test measurements collected in Activity 208.7. The resulting accuracy will be dependent on the completeness and accuracy of the available data. Deliverables will include calibrated model files and comparison spreadsheets exhibiting the agreement between simulated and measured data. This task will conclude with the development of a report chapter detailing the model selection, construction, and calibration efforts.

### Task 210: Existing Water System(s) Assessment

Objective: To assess the City's existing water distribution system ability to meet Level of Service and Design Standards (Activity 210.1) under the existing maximum day water demand in the period 2014 to 2019 plus fire flow scenarios at critical locations in the City water system as noted above. A summary of existing system deficiencies and recommendations for improvements will be provided.

- ✓ Task 302 - Engineer will provide high-level analysis of the existing water and sewer infrastructure within the City of Douglas to determine to capacity and constraints of the existing utility system based on data provided by the City was included in the Water and Wastewater Feasibility Report. As this task has

changed from high level to detailed hydraulic modeling, reduced hours are provided to account for the change in detail.

#### **Activity 210.1 - Confirm Level of Service and Design Standards**

Stantec will forward a draft level of service statement to City staff for their input and confirmation. These level of service criteria will function as a standard with which to judge the performance of the existing system. For example, criteria could include a minimum of 40 psi anywhere in the City water system on maximum day demand and 20 psi anywhere in the system on maximum day demand plus fire flow requirements for the water system. It is assumed that there is only one fire on maximum day demand. The City may have other criteria that will be adopted.

The City will identify the fire flow requirements (gallons per minute and the fire flow duration) at critical locations in the City water system typically as recommended to the City by the insurance Advisory Organization or the State of Arizona. The City will identify the location of the each critical infrastructure location. These fire flows will be used in the individual modeling runs at the nodes associated with the critical infrastructure.

#### **Activity 210.2 - Analysis of Wells, Storage, and Pumping Facilities**

Stantec will compute the current reliable water supply for the City, based upon current production statistics for the groundwater wells. Stantec will calculate the adequacy of the current storage facilities.

While the water source delivery system, in the case of the City the groundwater wells, are designed to meet system maximum day water demand, while the storage reservoirs are sized to meet water system peak hour demand, fire flow demand and fire flow duration and emergency reserve.

The firm, or reliable, pumping capacity will be calculated and compared to City water demand statistics to determine its adequacy.

#### **Activity 210.3 - Evaluation of Distribution System**

Stantec will quantify system in model output the pressures, flows, velocities, and head loss gradients for the average day demand (ADD) 2014 to 2019, the maximum day demand (MDD) in the period 2014 to 2019 and peak hour demand in the period 2014 to 2019 (PHD) scenarios. Available fire flows will also be quantified for their occurrence during the MDD scenario.

GIS layers will be created from the hydraulic model output files and maps created to highlight the results. Stantec will examine up to two additional "stressed system" scenarios as necessary and as envisioned by the City.

#### **Activity 210.4 - Summarize Existing System Deficiencies & Solutions**

The team will prepare a draft report chapter outlining the bottlenecks and other deficiencies identified by the hydraulic model in the existing system and recommendations to improve these deficiencies.

#### **Activity 210.5 - Progress Review Meeting**

Stantec will attend a progress review meeting via teleconference, to present the results.

#### **Task 211: Future Water System(s) Assessment**

Objective: Expand the hydraulic model pipes and nodes and otherwise examine the behavior of the future water distribution system network necessary to provide water to locations determined in Task 303 of the Water and Wastewater Feasibility Report (Douglas POE) and account for future growth as determined in Task 403 ("Commercial and residential growth capacity for the area..POE').

The water mains and required infrastructure to serve the Port of Entry and other areas identified in Task 303 of the Water and Sewer Feasibility Report will then be added to the model of existing maximum day



demand and fire flows. This infrastructure will be dependent upon the future sources and magnitudes of water supply which will be identified by the Stantec hydrogeological staff.

The water demands corresponding to the Port of Entry and other areas served by each future node will be calculated and added to the model. The hydraulic model will be used to size the water distribution system piping needed. The performance of these updated scenarios will then be analyzed and documented. The system evaluation, modeling, and results will fully describe the identified problems within the system and allow for the development of initial approaches to resolving the deficiencies.

- ✓ Task 303 of the Water and Wastewater Feasibility Report includes determination of required upgrades to Douglas system(s) for the Port of Entry and is not included in this task.
- ✓ Task 305 of the Water and Wastewater Feasibility report includes preliminary Hydraulic Analysis to size Pipe, Pump Stations, & Storage and is not included in this task.
- ✓ Task 403 of the Water and Wastewater Feasibility Report includes analysis of commercial and residential growth capacity for the area and is not included in the following task.

### **Task 212: Groundwater Resources Investigation**

Objective: Perform desktop analysis to provide high level recommendations on the location and capacity of two (2) future groundwater wells in the City water distribution system, that in agreement with the City, will be included in the water system model.

Stantec will conduct a brief desktop investigation of groundwater resources in the vicinity of Douglas, AZ. This includes identification of registered well sites, depths to groundwater, groundwater elevations and flow directions. Water quality of groundwater will also be evaluated.

All portions of the groundwater investigation will be constrained by researching only existing and available reports, no field investigations, flow measurements, or water quality sampling is anticipated as part of this desktop investigation. No groundwater modeling is included as part of this phase of work. The results of the investigation will include a brief narrative describing the findings of the investigation along with a map showing registered well locations and estimated groundwater elevations and flow directions.

Based on the findings of the desktop investigation, regions will be identified for further investigation of subsurface characteristics and for potential well sites. No borehole drilling, well construction, or testing is part of this investigation phase.

## **2. Deliverables**

Deliverables to Cochise County within the water and wastewater feasibility report will include a summary of analysis of the capacity and constraints of the existing water system(s) as well as analysis of proposed connections to the new port of entry, U.S. Border Patrol, Cochise College, the BDIA, along the utility corridor to Douglas, and future growth models. This data will be used to size pipes, pumps, and storage requirements accurately for future planning and cost estimates. Hydraulic data will be included in an appendix of the report.

The City of Douglas will receive a stand-alone report detailing the hydraulic modeling, input data, assumptions, and recommendations for the existing system(s) including analysis to determine the effects of two new wells to the system and recommendations for the existing water system(s). Improvements required for the planned water and wastewater extensions will be provide as well as an electronic copy of hydraulic model.



**Water & Wastewater Feasibility Report - Change Order #1: City of Douglas Water System Hydraulic Model & Evaluation - Budget of Fixed Fee**

STAGE & TASK DESCRIPTION		ALLOCATED HOURS								COST SUMMARY - \$	
		Project Manager Ruiz \$219	Principal Bryck \$219	Hydraulics Lead Georgalas \$193	GIS & Modeling TBD \$149	GIS & Modeling Goode \$193	GIS & Modeling Graves \$185	GIS & Modeling Wang \$159	Clerical Support Various \$113	Total Hours	Labor Fee
<b>TASK 208 - HYDRAULIC MODEL DATA</b>											
	Process Available Digital Mapping and GIS Layers			6						6	\$1,158
	Process Facility Maps / Data (Wells, Storage, and Pumping)			8						8	\$1,544
	Digitize Available Operational Data			8						8	\$1,544
	Field Testing (Facility Data, System Pressures, and Hydrant Flows)	2		8						10	\$1,982
<b>TASK 209 - HYDRAULIC MODEL CONSTRUCTION AND CALIBRATION</b>											
	Model Construction			16						16	\$3,088
	Generation and Allocation of Water Demands			8						8	\$1,544
	Model Calibration			12						12	\$2,316
<b>TASK 210 - EXISTING SYSTEM ASSESSMENT</b>											
	Confirm Level of Service and Design Standards		2	2						4	\$824
	Analysis of Wells, Pumping, and Storage			6						6	\$1,158
	Evaluation of Distribution System			12						12	\$2,316
	Summarize Existing System Deficiencies			8						8	\$1,544
	Progress Review Meetings	2	2	2						6	\$1,262
<b>TASK 211 - FUTURE SYSTEM ASSESSMENT</b>											
	Future System Assessment (Assume 3 scenarios)	2		24						26	\$5,070
<b>TASK 212 - GROUNDWATER RESOURCES INVESTIGATION</b>											
	Future System Assessment			2		1	3	26		32	\$5,268
<b>TASK 213 - DOCUMENTATION</b>											
	Draft Report Preparation and Review	2	4	30						36	\$7,104
	Report Finalization		6							6	\$1,314
	QA/QC		4							4	\$876
<b>Column Totals:</b>		<b>8</b>	<b>18</b>	<b>152</b>	<b>0</b>	<b>1</b>	<b>3</b>	<b>26</b>	<b>0</b>	<b>208</b>	<b>\$39,912</b>