CITY OF NOVI CITY COUNCIL
MARCH 28, 2022

SUBJECT: Approval to award services to ICS Integration Services for the design and implementation of operational improvements at the West Park Booster Station, in the amount of $56,500.

SUBMITTING DEPARTMENT: Department of Public Works, Water and Sewer Division

EXPENDITURE REQUIRED	**$ 56,500.00**
AMOUNT BUDGETED	**$ 200,520.00**
APPROPRIATION REQUIRED	**$ 0**
LINE ITEM NUMBER	**592-592.00-976.139**

BACKGROUND INFORMATION:

The Water and Sewer Division has been working with OHM Advisors on a detailed analysis of the West Park Booster Station (WPBS) to develop a process control narrative (PCN) for improved operational flexibility of the WPBS. Development of the PCN will require physical improvements and reprogramming, provided by the City's SCADA system integrator ICS Integration Services . ICS will provide electrical design, PLC programming, and SCADA programming services to implement the proposed booster station improvements. These improvements will increase the station's functionality and reliability, allowing the station to automatically adjust flow and pressures. This aids in avoiding avoid low pressure events periodically experienced within the water system.

The attached proposal from ICS outlines the detailed scope of services. The goal is to implement these improvements this spring before the irrigation season begins, allowing the modifications to be tested before the high demand period.

RECOMMENDED ACTION: Approval to award services to ICS Integration Services for the design and implementation of operational improvements at the West Park Booster Station, in the amount of $56,500.

ICS Integration Services LLC

1091 Centre Rd, Suite 190
Auburn Hills, MI 48326
Tel: (248) 765-5578
Fax: (734) 785-6025

03/08/2022

Michael Morianti

Subject: West Park Booster Upgrades

ICS Integration Services LLC is pleased to submit pricing for the above-mentioned project. This proposal is based on the process control narrative and Scope of work provided by Michael Morianti. Any changes or additional addendums will need to be reviewed for impact to our proposal.

SCOPE OF SERVICES

Materials Provided:

- 2 pressure transducers for Cla-Val 10" PRV and Cla-Val 12" PRV
- Additional miscellaneous parts for wiring terminals and fuses for analog signals from the position sensor and

Cost…….…….$6,500.00

Electrical Design Services:

- Provide integration drawings for integrating above materials with the Cla-Val 10" PRV
- Provide integration drawings for integrating above materials with the Cla-Val 12" PRV

Submittals:

- Provide material submittals
- Provide drawings submittals

Installation:

- ICS will **NOT** run conduit and wire up the devices. This will need to be done by an electrical contractor. Onsite support of installation is not included.
- ICS will startup and configure pressure transducers. This includes verification of signals back to the PLC and setting up proper scaling.

Time Estimate……...….60 Hours
Cost…….....$7,500.00

PLC Programming:

- Add logic to integrate new position sensors and pressure transducers.
- Add logic to calculate the flow thru the valves from the position and pressure sensors.
- Data collection of the system flows and pressures to determine the best way to implement the changes.

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- Create four different modes in the program per the Process Control Narrative supplied by OHM.
    - Normal Mode
    - Peak Shaving Mode
    - Exclusionary Boost Mode
    - Emergency Boost Mode
- These changes will all be implemented methodically and very deliberate. We will always have a path back to how it worked before.

Time Estimate……..……...…160 Hours
Cost…….... $20,000.00

SCADA Programming Services:

- Modify screens to add new signals (Position, Pressures, and Flow)
- Create new screen if necessary to show Modes and add set points for modes.
- Field startup, debug, and commissioning (Not to exceed 2 weeks on site)
- SCADA Screens will be developed per Novi standards. A screen review will take place during development and final screen approval and sign offs will be provided.

Time Estimate…..……..……..……..……60 Hours
Cost……..……..…… $7,500.00

Start up on site
Time Estimate……..…….80 Hours
Cost……..…$10,000.00

Project Management
Time Estimate……..…….40 Hours
Cost……..…… $5,000.00

Total Not To Exceed Price……. $56,500.00

NOTES

- **All devices will be supplied by ICS to be installed and wired by electrical contractor. ICS does not perform electrical or mechanical installation services. Those services will be the responsibility of bidding contractors.**
- **ICS has provided as part of this proposal a copy of our current insurance coverages, any additional coverages or changes required beyond what is listed in the provided accord certificates will result in additional charges.**

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TERMS

All prices shall remain in effect for 60 days.

GENERAL CONDITIONS

1. Our price does not include the following:
   - Electrical/Mechanical/Pneumatic Installation of any type
2. ICS Integration Services will not be responsible for correctness or accuracy of any information supplied by others or the subsequent errors resulting from such incorrect information.
3. ICS Integration Services will not be held liable for any schedule delays due to approvals and/or errors or omissions of others.

Thank you for the opportunity to quote these services. Should you have any questions regarding this proposal, please do not hesitate to contact me.

Thanks,

Michael Wegner
President
ICS Integration Services LLC
Tel: (248) 765-5578
mikewegner@icsintegrationllc.com

technical memorandum

Date: February 24, 2022

To: Ben Croy, City Engineer, City of Novi
Jeff Herczeg, Director of Public Services, City of Novi
From: Michael Morianti, PE, Project Engineer, OHM Advisors
CC: Lambrina Tercala, PE, Senior Project Manager, OHM Advisors

Re: Improve Operational Flexibility at West Park Pump Station
Recommendation on Project's Critical Path

Overview

In July 2021, OHM Advisors (OHM) completed a technical assessment of the operational challenges at the West Park and Island Lake Booster Stations. This assessment identified control system solutions to improve the West Park Pump Station operation and reliability. Using the July 2021 assessment, OHM proposed a scope of design and implementation services to address the deficiencies. On January 19, 2022, the City of Novi authorized OHM to proceed with the proposed scope of work. This technical memorandum relates to Task 1 of the authorized proposal and presents the findings of OHM's assessments and recommendation on the project's critical path.

This technical memorandum provides our deliverables as part of Task 1 of the proposal:

- Recommendation of Flow Measurement Type
- Critical List of Equipment
- Anticipated Project Schedule

Flow Measurement Type

To implement the proposed process control modifications for the West Park Pump Station (WPPS), which were outlined in the Station Assessments Technical Memorandum (July 26, 2021), the local control system must provide a SCADA connected flow signal. OHM considered multiple flow metering options, including an insertion flow meter and clamp-on ultrasonic meter. However, due to installation limitations on straight run requirements, OHM narrowed the analysis down to two alternatives:

- Alternative #1 – Cla-Val Formula
- Alternative #2 – In-Line Magmeter

Alternative #1 – Cla-Val Formula

The two existing pressure reducing valves (PRVs) at the station were manufactured by Cla-Val. The PRVs are integral to the operation of the system, in good condition, and expensive to replace. Therefore, any flow measurement method needs to be compatible with the Cla-Val equipment. In discussions with Cla-Val representatives, they presented the Cla-Val Formula as a proprietary method to calculate flow through a PRV. The formula requires three process inputs: upstream pressure, downstream pressure, and the position (% open) of the PRV. To capture these signals at the station, a contractor must install one upstream pressure sensor, one downstream pressure sensor, one position transmitter for the 10" PRV, and one position transmitter for the 12" PRV. The signals will be integrated

into the local Programmable Logic Controller (PLC), inputted into the proprietary formula programmed within the PLC, and return a flow value updated continuously.

Alternative #2 – In-Line Magmeter

The In-Line Magmeter is a common flow meter device, which typically requires an ideal flow profile to ensure accurate readings. Most magmeters require a straight run of five pipe diameters upstream and two pipe diameters downstream. However, newer magmeters are capable of measuring flow independently of flow profile and mounting location. One example of a device with this capability is the Endress+Hauser Promag W with the 0 x DN full bore option. This technology is well suited for installation in tight spaces, avoids pressure loss, and maintains a high accuracy.

Assessment of Alternatives

OHM considered equipment lead time, accuracy, future maintenance needs, life expectancy, and cost to evaluate the two alternatives. Table One below contains the product data for ease of comparison.

Equipment Comparison

Schedule Impact

- The procurement lead time for the Cla-Val Formula equipment should be shorter than the In-Line Magmeter equipment.
- The installation time for the Cla-Val Formula equipment is expected to take one to two days. No penetrations are expected and the modified PRVs will be used for process connections. The In-Line Magmeter needs three to five days for installation because the station requires retooling. The installation time for Alternative #1 is expected to be shorter by two days.

Maintenance of Operations During Construction

- The Cla-Val Formula would use existing ports or add fittings at the PRV to connect the pressure transmitters. The position transmitters would be mounted externally on the valve stem extension of the main valve. With no piping modifications required, this alternative avoids an extended shut down during installation. Work can be completed in April 2022, and finish before irrigation demands ramp up in May 2022.
- The In-Line Magmeter would have to undergo a station shut down to reconfigure the piping and install the magmeter. The only feasible time for an extended station shutdown would be outside of irrigation season during the winter months. Therefore, this work cannot start until December 2022 at the earliest.

Accuracy

- The In-Line Magmeter measurement accuracy is superior at +/- 0.5%, compared to an accuracy of +/- 2.0% for the Cla-Val Formula based on manufacturer's literature. Since flow is used for process control and not billing, measurement accuracy within 2.0% is acceptable.

Maintenance

- Both alternatives require minimal maintenance after commissioning and should not be a determining factor.

Life Expectancy

- The In-Line Magmeter has a 30-year life expectancy, while the position transmitter and pressure transmitter have a 10- and 20-year life expectancy respectively. This is primarily due to the magmeter having no moving parts, while the position and pressure transmitters undergo mechanical wear and tear while in use.
- The costs to replace the pressure and position transmitters will be approximately 75% of the capital cost (adjusted for inflation) for the original installation. The costs to replace the magmeter, should be approximately 50% of the capital cost (adjusted for inflation) for the original installation because no retooling will be required.

Capital Cost

- The In-Line Magmeter alternative is estimated to cost $4,000 more than the Cla-Val Formula alternative.
- The Cla-Val Formula alternative cost is more than originally anticipated. The position transmitter (quoted at $5,9000 each) is the primary driver of the higher cost.

Table 1: Flow Measurement Alternatives Comparison

PARAMETERS	ALT #1 (CLA-VAL)	ALT #2 (MAG)	ADVANTAGE
Lead Time (weeks)	5-7	6-8	Cla-Val Formula
Installation Time (days)	1-2	3-5	Cla-Val Formula
Accuracy +/- %	2	0.5	In-Line Magmeter
Maintenance Needs	Minimal	Minimal	Neither
Life Expectancy (years)	10-20	30	In-Line Magmeter
Capital Cost Estimate*	$21,000	$25,000	Cla-Val Formula

*Does not include electrical or integration costs.

Engineer's Recommendations

The Cla-Val Formula holds an advantage over the In-Line Magmeter in the schedule, installation time, and upfront costs. While the In-Line Magmeter is more accurate, more durable, and should be less costly over the life of the station. Since the Cla-Val Formula is not used for billing, an accuracy of +/- 2% is acceptable. Because Novi needs to implement operational changes by summer 2022, OHM recommends Novi modify the station using Alt #1, Cla-Val Formula. ICS, Novi's SCADA Integrator, also endorses selection of Alt #1, Cla-Val Formula.

Listing of Critical Equipment

OHM developed the below Equipment Schedule for the project's critical parts, along with location, anticipated lead time, anticipated manufacturer and model number.

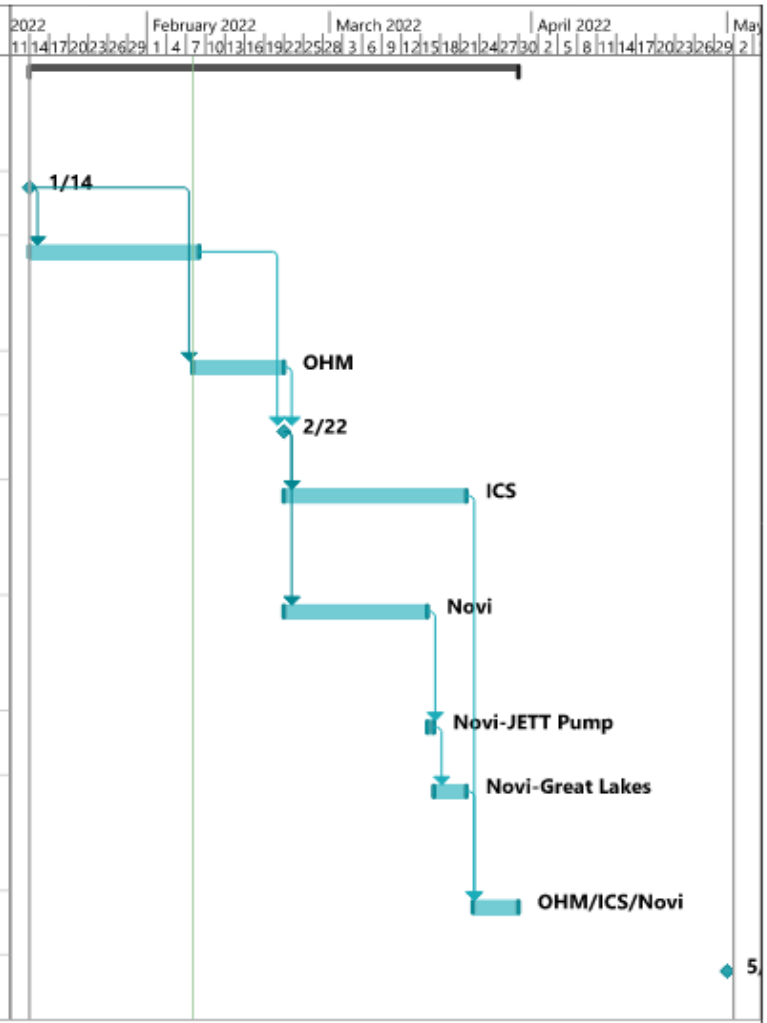
EQUIPMENT SCHEDULE				
NO	**DESCRIPTION**	**LOCATION**	**MANUFACTURER/MODEL**	**ANTICIPATED LEAD TIME**
1	Valve Position Transmitter	10" PRV	Cla-Val / X117H	1 week
2	Valve Position Transmitter	12" PRV	Cla-Val / X117H	1 week
3	Upstream Pressure Transmitter	Fitting at 10" or 12" PRV	ABB / 266HSH and 266NSH	5-7 weeks
4	Downstream Pressure Transmitter	Fitting at 10" or 12" PRV	ABB / 266HSH and 266NSH	5-7 weeks

Note: Equipment list relates to Alternative #1 only, per recommendation in OHM's February 2022 technical memo.

Project Schedule

OHM developed the below Project Schedule for the project's critical tasks. 30 calendar days of float time was built into the schedule to allow for schedule flexibility and unexpected delays.

ID	Task Name	Duration	Start	Finish	Predec	Resource Names
1	**West Park Controls Changes Winter 2022**	**53 days**	**Fri 1/14/22**	**Tue 3/29/22**		
2	Kickoff	0 days	Fri 1/14/22	Fri 1/14/22		OHM/Novi
3	Flow Meter Recommendation/Research	18 days	Fri 1/14/22	Tue 2/8/22	2	
4	Process Control Narrative	10 days	Tue 2/8/22	Mon 2/21/22	2	OHM
5	Process Control Meeting	0 days	Tue 2/22/22	Tue 2/22/22	4,3	OHM/ICS/Novi
6	Pre-programming and Coord w/Engineer	20 days	Tue 2/22/22	Mon 3/21/22	5	ICS
7	Procure Transducer/flow controller/position transmitter	16 days	Tue 2/22/22	Tue 3/15/22	5	Novi
8	Equipment install	1 day	Wed 3/16/22	Wed 3/16/22	7	Novi-JETT Pump
9	Electrical - conduit/pull wire/final connections	3 days	Thu 3/17/22	Mon 3/21/22	8	Novi-Great Lakes
10	Commissioning/testing	5 days	Wed 3/23/22	Tue 3/29/22	9,6	OHM/ICS/Novi
11	NO MORE WORK	0 days	Sun 5/1/22	Sun 5/1/22		



memorandum

Date: December 13, 2021

To: Ben Croy, Scott Roselle – City of Novi
cc: Matt Kennedy, Lambrina Tercala – OHM Advisors
From: Michael Morianti – OHM Advisors

Re: City of Novi – West Park Booster Station Control System Modifications Plan

OHM Advisors (OHM) is pleased to submit this plan for control system modifications to the West Park Booster Station (WPBS). In July 2021, OHM completed a technical assessment of the operational challenges at the West Park and Island Lake Booster Stations. The assessment identified root cause problems and proposed preliminary solutions to enhance the stations' operations and reliability. The City of Novi (Novi) has expressed interest in moving forward with these station improvements, but before doing so, needs a defined scope and cost estimate.

The memo Attachments detail the scope of work, process control narrative outline, and estimated cost of improvements.

To facilitate your review, this plan is organized as follows:

- Attachment A – Contractor Scope of Work
- Attachment B – OHM Support Services
- Attachment C – Process Control Narrative (PCN) Outline
- Attachment D – Engineer's Opinion of Probable Cost
- Attachment E – ICS Cost Estimate

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34000 PLYMOUTH ROAD
LIVONIA, MICHIGAN 48150
T 734.522.6711
F 734.522.6427
OHM-Advisors.com

Attachment A – Contractor Scope of Work

CONTRACTOR SCOPE OF WORK

'Contractor' for the purpose of this project is assumed to be a Supervisory Control and Data Acquisition (SCADA) Integrator. The Contractor shall provide the material, equipment, and labor for the electrical, instrumentation, and controls work as specified here:

1. SCADA design services for adding instrumentation to the booster station
    a. Add modifications to the power wiring diagram
    b. Add modifications to the I/O wiring diagram

2. Furnish and install two position transmitters
    a. Device: Cla-Val Model X117D Valve Position Transmitter
    b. One position transmitter for the 10" pressure reducing valve (PRV)
    c. One position transmitter for the 12" PRV

3. Furnish and install two pressure transmitters
    a. One installed upstream of PRVs
    b. One installed downstream of PRVs

4. Integrate two position transmitters: one for a Cla-Val 10" PRV and one for a Cla-Val 12" PRV.
    a. Perform loop checks
    b. Test and verify instrument accuracy

5. Integrate two pressure transducers (upstream and downstream) on the 10" PRV
    a. Perform loop checks
    b. Test and verify instrument accuracy

6. Perform PLC programming
    a. Add pressure, position, and flow tags
    b. Using the Cla-Val proprietary formula (which will be provided), program the Programmable Logic Controller (PLC) to convert position and pressure signals to a flow value (gpm)
    c. Program 4 station modes of operation (see Process Control Narrative, Attachment C to December 2021 memo)
        i. Create All Year Normal Mode
        ii. Modify Peak Shaving Mode
        iii. Create Exclusionary Boost Mode
        iv. Create Emergency Boost Mode
    d. Verify all commands and statuses are reporting properly to the PLC

7. Perform operator interface terminal (OIT) programming
    a. Link position, pressure, and flow tags to OIT
    b. Add pressure values (4), position values (2), actual flow (2), and cumulative flow (2) displays to client approved OIT screen
    c. Modify screen to display mode of operation the station is currently in
    d. Add staging set points for the Peak Shaving Mode
    e. Verify commands and statuses are reporting properly to the SCADA system

8. Perform SCADA programming
    a. Link position, pressure, and flow tags to SCADA
        i. Add tags to the historian
    b. Add pressure values (2), position values (2), actual flow (2), and cumulative flow (2) displays to client approved SCADA screens
    c. Modify screen to display what mode of operation the station is currently in
    d. Add staging set points for the Peak Shaving Mode
    e. Verify commands and statuses are reporting properly to the SCADA system

9. Provide two days of onsite testing and start-up services
    a. Test and start-up supervision shall continue until the system is in proper operating condition as determined by the Engineer

10. Provide three hours of formal training for operators and other personnel on the system operation modes and HMI screens and controls.

11. Electrical work
    a. Furnish and install conduit and power/signal cabling to connect each instrument (four total) from point of installation to the PLC.
    b. May required installation of an additional analog input (AI) card, depending on AI point availability.

This contract shall not include the following work:

1. Modifications to PRV plumbing

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34000 PLYMOUTH ROAD
LIVONIA, MICHIGAN 48150
T 734.522.6711
F 734.522.6427
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Attachment B – OHM Supports Services

OHM SUPPORT SERVICES

The proposed support services are separated into the following tasks.

Task 1: Project Management

- Lead three, 1-hour virtual project meetings.
- Manage scope, workflow, and schedule with contractors.

Task 2: Process Control Narrative

- Write a detailed process control narrative (PCN) for the contractor to use for programming the station and as a reference for Operators and Programmers. The PCN shall include loop summaries, equipment logic, control summary, alarms, set points, data displays, permissives, and interlocks.

Task 2 Deliverables

- Detailed PCN

Task 3: Implementation Services

- Support commissioning of the upgraded control system
- Test and verify newly programmed operation modes
- Coordinate and review set points and alarming protocols
- Coordinate and review SCADA screens
- Write a brief commissioning report to describe the completed work and testing of the control system modifications and newly programmed operation modes

Task 3 Deliverables

- Commissioning report

Task 4: Pump Station Operations Manual

- Develop Operations Manual based on Process Control Narrative
- Provide updates to manual based on changes made during commissioning.

Task 4 Deliverables

- Operations manual

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F 734.522.6427
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Attachment C – Process Control Narrative Outline

BACKGROUND

This document provides a control narrative outline for the programming updates to the station PLC.

OUTLINED MODES OF OPERATION

The following operation modes should be updated at the WPBS PLC.

All Year Normal Mode – Pressure Reducing from High Pressure District to Intermediate District (Available 24 hours per day)

Function

The station uses flow through the 10” and/or 12” PRVs to reduce pressure from the high pressure district into the intermediate pressure district.

Conditions

All Year Normal Mode is the default operation for the WPBS, meaning the station should be running in this mode unless one of the other modes is triggered.

Equipment State

The control elements should be in the following states:

- 12” and/or 10” PRV should be open depending on Operator selection
- 24” suction valve (V-2) should be closed
- Ramp down pumps slowly when entering mode and keep pumps off unless turnover tank process is initiated
- Bring Lead Pump online to turnover tank daily or as scheduled.

Peak Shaving Mode – Supply water to Intermediate district from Ground Storage Tank and High Pressure District simultaneously (5:30 AM to 12:00 PM)

Function

The station will use capacity from the ground storage tank (GST) and flow through the PRVs to shave demand and avoid peak water charges from Great Lakes Water Authority (GLWA).

Conditions

The system shall initiate Peak Shaving Mode when the following conditions are satisfied:

- The time is between 5:30 AM to 12:00 PM local time; and
- GLWA_Tot_Flow is greater than Control_Flow for more than 10 minutes; and
- Tank level is above ___ ft

The system shall exit Peak Shaving Mode and return to All Year Normal Mode when the following conditions are satisfied:

- The time is between the 5:30 AM to 12:00 PM window; or
- GLWA_Tot_Flow is less than Control_Flow for more than 10 minutes

The system shall exit Peak Shaving Mode and transition to Daytime (Non-Exclusionary) Boost Mode when the following conditions are satisfied:

- Tank level is below ____ ft; and
- The downstream pressure at PIT-___ drops below ___ psi for 1 minutes; and
- GLWA_Tot_Flow is more than Flow_Transition_Buffer (initial SP 0.5 MGD) below the Control_Flow for 10 minutes

The system shall exit Peak Shaving Mode and transition to Mid-day Fill Mode when the following conditions are satisfied:

- Tank level is below ___ ft; and
- GLWA_Tot_Flow is less than Control_Flow for more than 10 minutes

Equipment State

Once Peak Shaving Mode is initiated, the following controls should be implemented:

- Open both PRVs
- Close 24" suction valve (V-2)
- Call pumps to run off Flow Rate calculation and follow sequential pump start protocol

Nighttime (Exclusionary) Boost Mode – Boost pressure to Intermediate District using water from High Pressure District (12:00 AM to 5:30 AM)

Function

The station will use flow through the PRVs and pumps to boost pressure from the high pressure district into the intermedia pressure district.

Conditions

The system shall initiate Nighttime (Exclusionary) Boost Mode when the following conditions are satisfied:

- The time is between 12:00 AM to 5:30 AM local time; and
- The upstream pressure at WPBS (PT-___) drops below ___ psi for 1 minute

The system shall exit Nighttime (Exclusionary)Boost Mode and return to All Year Normal Mode when the following conditions are satisfied:

- The time exists the 12:00 AM to 5:30 AM window; or
- The upstream pressure at WPBS PT-___ rises above ___ psi for 1 minute; or
- During the periodic ramp down, the upstream pressure at WPBS PT-___ rises above ___ psi for 1 minute

Equipment State

Once Nighttime (Exclusionary) Boost Mode is initiated, the following controls should be implemented:

- Open both PRVs
- Open 24" suction valve (V-2)
- Pumps to turn on and operate at Pressure Setpoint of ___ psi
- Every 20 minutes, pumps should slowly ramp down to 10 psi below the Pressure Setpoint to see if the PRVs can take over hydraulically

Daytime (Non-Exclusionary) Boost Mode – If Tank is out of service or has low water level; Rare Condition (5:30 AM to 12:00 AM)

Function

The station will use flow through the PRVs and pumps to boost pressure from the high pressure district into the intermediate pressure district.

Conditions

The system shall initiate Daytime (Non-Exclusionary) Boost Mode when the following conditions are satisfied:

- The time is between 5:30 AM to 12:00 AM local time; and
- The system is not in Peak Shaving Mode; and
- The downstream pressure at PIT-___ drops below ___ psi for 1 minutes; and
- GLWA_Tot_Flow is more than Flow_Transition_Buffer (initial SP 0.5 MGD) below the Control_Flow for 10 minutes

The system shall exit Daytime (Non-Exclusionary) Boost Mode and return to Peak Shaving Mode or All Year Normal Mode when the following conditions are satisfied:

- The time exists the 5:30 AM to 12:00 AM window; or
- Peak Shaving Mode conditions are met; or
- The upstream pressure at PIT-___ rises above ___ psi for 1 minutes; or
- GLWA_Tot_Flow has exceeded Control_Flow by more than Flow_Transition_Buffer (initial SP 0.5 MGD) for 10 minutes
- The upstream pressure at PIT-___ rises above ___ psi for 1 minute during the periodic ramp down

Equipment State

Once Daytime (Non-Exclusionary) Boost Mode is initiated, the following controls should be implemented:

- Open both PRVs
- Open 24” suction valve (V-2)
- Pumps to turn on and operate at Pressure Setpoint of ___ psi
- Every 20 minutes, pumps should slowly ramp down to 10 psi below the Pressure Setpoint of ___ psi, to see if the PRVs can take over hydraulically

OTHER MODES OF OPERATION

Other modes of operation are currently in use at the WPBS which OHM did not outline in this document. During development of the PCN, OHM will define the transition criteria and required programming changes for each mode. The other modes of operation which will be addressed include:

- Nighttime (Exclusionary) Tank Filling
- Tank Turnover
- Tank Mid-Day Fill

Attachment D – Engineer's Opinion of Probable Cost

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34000 PLYMOUTH ROAD
LIVONIA, MICHIGAN 48150
T 734.522.6711
F 734.522.6427
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Project Summary
Engineer's Opinion of Probable Project Costs

Owner: City of Novi
Project: West Park Booster Station Control Modifications
Work: Design & Install new instrumentation and update PLC/SCADA program, as defined

Date: 12/13/2021
Project No. 0163-21-0030
Prepared By: M. Morianti
Reviewer: L. Tercala

Item No.	Item Description	Vendor	Estimated Quantity	Unit	Unit Price	Total Cost
	SCHEDULED WORK					
1	Provide system integration services and instrumentation devices (see attached estimate for full description)	ICS	1	LS	$58,900.00	$58,900.00
2	Electrical work (materials and labor to wire new devices)	TBD Electrical Contractor	1	LS	$3,200.00	$3,200.00
3	Allowance for additional analog input card	TBD Electrical Contractor	1	EA	$1,000.00	$1,000.00
4	Install pressure, position, and flow monitoring at Meadowbrook PRV	TBD Electrical Contractor	1	LS	$10,000	$10,000.00
5	OPTIONAL – Move fill valve PLC and controls to above grade rack	ICS/Electrical Contractor	1	LS	$15,000	$15,000.00
6	OPTIONAL - Install pilot at North PRV to switch between high and low pressure operation through SCADA	ICS/Electrical Contractor	1	LS	$10,000	$10,000.00
7	OPTIONAL - Install pilot at Meadowbrook PRV to switch between high and low pressure operation through SCADA (OPTIONAL)	ICS/Electrical Contractor	1	LS	$10,000	$10,000.00
					SCHEDULED WORK SUBTOTAL	**$108,100.00**
	CONTRACTUAL REQUIREMENTS					
8	General Conditions	TBD Electrical Contractor	10%			$11,000.00
9	General Requirements	TBD Electrical Contractor	8%			$9,000.00
					CONSTRUCTION COST (BID CONTRACT)	**$128,100.00**
	TECHNICAL REQUIREMENTS					
10	Legal/Financial Service Fees		0%			$0.00
11	Bond Council Fees		0%			$0.00
12	Bid Advertisement Cost		0%			$0.00
13	Engineering Services (Attachment B)	OHM Advisors	15%			$17,000.00
14	Construction Administration & Oversight Services (Attachment B)	OHM Advisors	20%			$22,000.00
					PROJECT COST SUBTOTAL	**$167,100.00**
15	Project Contingencies		20%			$33,000.00
16	Inflation		6%			$10,000.00
					ENGINEER'S OPINION OF TOTAL CONSTRUCTION COST (+/- 20%)	**$210,100.00**

NOTES:
1. Values are rounded up to the nearest $100s.

ASSUMPTIONS:
1. No software costs are included
2. Construction work will be completed during non-peak season with major testing in March/April and prove out in June/July months.
3. No electrical service panel modifications are required

Attachment E – ICS Cost Estimate

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34000 PLYMOUTH ROAD
LIVONIA, MICHIGAN 48150
T 734.522.6711
F 734.522.6427
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