SYNERGY ENVIRONMENTAL, LLC

February 2, 2016

Mr. Richard Olm, PE
Waste Programs Division
Arizona Department of Environmental Quality
Phoenix, Arizona 85007

Re: Proposed Changes to the Operation and Maintenance Plan, Revision 7
Roosevelt Irrigation District Wellhead Treatment Systems

Dear Mr. Olm,

Synergy Environmental, LLC (Synergy) has prepared proposed revisions to update the ADEQ-certified Roosevelt Irrigation District (RID) Wellhead Treatment Systems Operation and Maintenance Plan (O&M Plan). The proposed revisions, as provided in Attachment 1 to this document, are shown in redline/strikeout to the current O&M Plan (Revision 6) that was submitted to Arizona Department of Environmental Quality (ADEQ) late last summer and approved by ADEQ via your email, dated September 9, 2015. For your records, we have also prepared a “clean” version of the updated O&M Plan (Revision 7) as Attachment 2 to this letter.

As you are aware, RID is required to review the Wellhead Treatment Systems O&M Plan at least annually for completeness and update the O&M Plan as appropriate. In preparation for RID’s upcoming operating year, we have reviewed the current O&M Plan and have proposed revisions to provide updated information and further context to the RID remedial actions that are governed by the O&M Plan. Such updates include the remedial actions pursuant to RID’s Feasibility Study Report, approved by ADEQ on April 13, 2015, which reduces the number of wells that will need treatment to only six wells from the eight wells required in the ADEQ-approved RID Modified Early Response Action, while still achieving all the Water Quality Assurance Revolving Fund (WQARF) remediation criteria and all remedial objectives established by ADEQ for the West Van Buren Area WQARF Site.

Your prompt approval of the updated O&M Plan is appreciated. Once approved, Synergy will submit a complete, stamped copy of the Revision 7 Wellhead Treatment Systems O&M Plan.

Best regards,
SYNERGY ENVIRONMENTAL, LLC

Joel Peterson, PE

cc: Misael Cabrera, ADEQ
Laura Malone, ADEQ
Donovan Neese, RID
David Kimball, Gallagher & Kennedy

ATTACHMENT 1

OPERATION & MAINTENANCE PLAN

RID WELLHEAD TREATMENT SYSTEMS

JANUARY
2016
Revision 7

WEST VAN BUREN AREA WQARF SITE
PHOENIX, ARIZONA

Prepared for: **Arizona Department of Environmental Quality**

Prepared by: **Synergy Environmental, LLC**

On Behalf of: **Roosevelt Irrigation District**

TABLE OF CONTENTS

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TABLE OF CONTENTS (Continued)

TABLES

FIGURES

APPENDICES

Synergy Environmental, LLC

TABLE OF CONTENTS (Continued)

APPENDICES (Continued)

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January 2016, Revision 7

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OPERATION AND MAINTENANCE PLAN – RID WELLHEAD TREATMENT SYSTEMS

WEST VAN BUREN AREA WATER QUALITY ASSURANCE REVOLVING FUND SITE

1.0 INTRODUCTION

Groundwater in the West Van Buren Area Water Quality Assurance Revolving Fund Site (WVBA Site) contains hazardous substances, principally volatile organic compounds (VOCs) that have impacted Roosevelt Irrigation District (RID) production wells. Arizona Department of Environmental Quality (ADEQ) acknowledged that the RID wells that extract and discharge VOC-contaminated groundwater to surface water are the major outflow of contamination from the Site (Terranext, 2012). It was further noted that the RID canals provide a potential route of surface water contaminant migration within and downstream of the WVBA Site.

RID relies on the wells within the WVBA Site to meet critical water supply needs and, consequently, submitted a Work Plan for conducting an Early Response Action (ERA) to restore a portion of these impacted wells for current and reasonably foreseeable beneficial uses, including future use as a drinking water source (Montgomery & Associates, 2010), as provided in the Arizona Water Quality Assurance Revolving Fund Program:

- Arizona Revised Status (ARS) §49-282.06.B.4.b; and,
- Arizona Administrative Code (A.A.C.) R18-16-405.

Although the ERA was designed to capture and treat hazardous substances primarily as a well protection and water supply initiative, the action was also proposed to mitigate public exposure associated with the uncontrolled release of VOCs in groundwater pumped by RID from the WVBA Site. Air and water sampling was conducted in accordance with the *Public Health Exposure Assessment and Mitigation Work Plan* (Synergy Environmental [Synergy], *2011a)*. The resulting data enabled review of the potential insight into the fate and transport of these contaminants (Synergy, 2011b). The assessment compared the sampling results to health-based guidelines to make a screening-level determination as to whether these substances pose a significant risk to public health and provide data to assist in developing detailed designs for engineering controls to limit uncontrolled VOC emissions.

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Consistent with the Task 4-Engineering Design Study required by the ADEQ in the ERA conditional approval letter of June 24, 2010 (ADEQ, 2010), RID submitted a proposal to construct and operate a pilot wellhead treatment system at RID-95 and additional wellhead treatment at select sites (Synergy Environmental, 2011c). In a letter dated September 2, 2011, ADEQ authorized implementation of RID's proposed Pilot System initiative (ADEQ, 2011).

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Before initiating treatment at the additional well sites (i.e., RID-89, RID-92 and RID-114) under RID's proposed Pilot System initiative, RID agreed to prepare and submit a near-term assessment, following one month of system operation, to consider the technology, system design and site-specific engineering and operation controls to determine the effectiveness of liquid-phase granular activated carbon (LGAC) and the reliability of the system as designed/operated to provide safeguards to protect public health in the event of system failures (in accordance with A.A.C. R18-16-411). The *1-Month Technology/Design Demonstration Report: RID-95 Pilot System* (Synergy, 2012a), describes the successful completion of the assessment period, which demonstrated the reliable operation of the treatment system without identification of any design or operational issue that could reasonably endanger public health.

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On July 17, 2012, a Modified ERA Proposal (Synergy, 2012b) was submitted to ADEQ as an addendum to the original ERA Work Plan, dated February 3, 2010 and conditionally approved by ADEQ on June 24, 2010 (ADEQ, 2010). The addendum was proposed in order to provide a more cost effective approach to accomplish the goals of the ERA remedial action. The Modified ERA Proposal provided an optimized design approach to address the highest contaminated RID wells located in the WVBA Site and incorporated information and insights gained from the investigations prescribed by ADEQ in the original ERA Work Plan letter (Tasks 1 through 4) and from the Pilot System initiative. Based on the detailed consideration and analysis of this new information, RID proposed substantive modifications to the original ERA Work Plan, which included utilizing a combination of treatment and blending to effectively reduce the concentration of VOCs from several additional, lower concentration wells resulting in lower volume of water being directly treated while providing a higher total volume of groundwater that is remediated to meet applicable federal maximum contaminant levels (MCLs). On October 19, 2012, Synergy submitted the Modified ERA Work Plan to ADEQ, which incorporated applicable content from the original ERA Work Plan and from the Modified ERA Proposal (Synergy, 2012c). In a letter dated February 1, 2013, ADEQ conditionally approved the Modified ERA Work Plan (ADEQ, 2013).

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In July 2014, RID submitted a Feasibility Study Report (Synergy, 2014a) to ADEQ pursuant to the RID Feasibility Study Work Plan approved by ADEQ on July 16, 2013. The RID Feasibility Study Report was prepared to evaluate possible groundwater alternative remedies and determine a proposed groundwater remedy for the WVBA Site that would address all RID wells that would not be fit for their current and reasonably foreseeable end uses due to the releases of VOC contaminants (in accordance with ARS §49-282.06.B.4.b). Remedial strategies and measures were developed to meet all applicable remedial action criteria in ARS §49-282.06 and A.A.C. R18-16-407 and formulated into possible groundwater alternative remedies that are capable of achieving the Remedial Objectives established by ADEQ for the WVBA Site. RID submitted a revised Feasibility Study Report (Synergy, 2014b) to ADEQ on November 26, 2014 that addressed comments from ADEQ and was subject to public comments and a public meeting. ADEQ approved RID's Feasibility Study Report, including the proposed remedial action, on April 13, 2015 (ADEQ, 2015).

Consistent with the ADEQ letter dated September 2, 2011, that agreed with implementation of the Pilot System initiative, the *Long-Term Operational Assessment Report, RID-95 Wellhead Pilot Treatment Systems* documented the long-term performance of the wellhead treatment systems in order "…*to determine whether well head treatment can be an effective treatment technology*…(that results in)…*reducing the cost of the final remedy*…*and/or mitigating contaminant exposure*" (Synergy, 2012d). The Assessment Report indicated that the RID Pilot System initiative conclusively demonstrated the cost effectiveness of the technology, and therefore the reasonableness of the selected remedy in the Modified ERA that was incorporated and expanded in the Feasibility Study Report in order to effectively treat the contaminated groundwater impacting RID's wells and the successful mitigation of public health exposures to these contaminants at all impacted RID wells.

Pursuant to A.A.C. R18-16-411, RID was to prepare and submit an Operation and Maintenance (O&M) Plan to ADEQ to implement all or any portion of a remedy or early response action. This O&M Plan, which was certified by ADEQ on April 10, 2015, provides equipment and construction details, the sampling and analysis program, and specific O&M and reporting procedures for the RID wellhead treatment systems included in the ADEQ-approved remedial actions, and shall replace all previous editions. Updates and/or revisions will continue to be made to this O&M Plan, as necessary. At a minimum, this O&M Plan will be reviewed on an annual basis to confirm accuracy and completeness.

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2.0 BACKGROUND

A summary of the physical setting, hydrogeologic and groundwater conditions, sources of contamination and impacts on RID wells and operations was provided in the WVBA Site Remedial Investigation (RI) Report (Terranext, 2012). The RI Report was published by ADEQ in August 2012, and included a discussion of the nature and extent of contamination in the WVBA Site. Brief descriptions of the Site location and physical characteristics, the contaminants of concern (COCs) present at the Site and the impact of the contamination on the RID water systems are provided in the following sections.

2.1 SITE LOCATION AND PHYSICAL CHARACTERISTICS

Land use within the WVBA is predominantly zoned industrial with smaller tracts of residential (with elementary schools and churches) and commercial. The WVBA Site is located within the City of Phoenix Central City and Estrella urban villages (**Figure 1**). Based on data generated through applied use of the Environmental Justice Screening and Mapping Tool (EJSCREEN) developed by the U.S. Environmental Protection Agency (EPA), there are approximately 51,600 people residing within the general boundaries of the WVBA Site and the demographic profile indicates the residents predominantly comprise a low income, minority population.[1] With the significant acreage of agricultural land available to be developed in the future, the Estrella Village (41 square miles) is identified as a Phoenix targeted growth area, and is expected to experience significant increases in both employment and residential growth (Synergy, 2011b).

Figure 2 depicts the approximate boundaries of the groundwater contamination, as well as relevant features within the WVBA Site. The extent of groundwater contamination associated with the WVBA Site is generally bounded on the north by McDowell Road, on the east by 7th Avenue, on the south by Lower Buckeye Road, and on the west beyond 79th Avenue.

2.2 CONTAMINANTS OF CONCERN

The COCs in the WVBA Site have been identified based on historical and present data obtained from samples collected by ADEQ and RID from the impacted RID groundwater supply wells over the past 20 years. These COCs comprise the commingled WVBA Site plume and are listed as follows (including the chemical name and the Chemical Abstract Service (CAS) number:

- 1,1-Dichloroethene (1,1-DCE) CAS number 75-53-4

[1] *See* www.epa.gov/ejscreen for environmental indicators and demographic data applicable to the general boundaries of the WVBA Site.

- Tetrachloroethene (PCE) CAS number 127-18-4
- Trichloroethene (TCE) CAS number 79-01-6
- 1,1,1-Trichloroethane (TCA) CAS number 71-55-6
- cis 1,2-Dichloroethene (cis 1,2-DCE) CAS number 156-59-2
- 1,1-Dichloroethane (1,1-DCA) CAS number 75-34-3

Chromium is also a COC that occurs locally within the WVBA Site boundaries. The chromium concentrations in the impacted RID wells (Synergy, 2014b) are well below the federal MCL for drinking water and have only been detected in two (2) wells: RID-102 and RID-104; neither of which was selected for wellhead treatment. Consequently, chromium is not included in the sampling and analysis program as part of this O&M Plan.

Only three (3) of the listed COCs (i.e., TCE, PCE and 1,1-DCE) are present in the impacted groundwater within the WVBA Site at concentrations that exceed the MCLs. Consequently, these COCs are referred to as the "target COCs" in this O&M Plan. The target COCs will be used to determine when GAC replacement is necessary.

2.3 WATER QUALITY – TREATMENT SYSTEM WELLS

A summary of recent historical analytical data that presents target COC concentrations for samples collected by ADEQ from RID treatment system wells is included below. All results that are equal to or exceed MCLs are indicated in red text.

Table 1. Summary of Recent Water Quality – Treatment System Wells

All concentrations are presented as micrograms per liter (μg/L):

Sample Date	Well RID-89			Well RID-92			Well RID-95			Well RID-114		
	TCE	PCE	1,1-DCE	TCE	PCE	1,1-DCE	TCE	PCE	1,1-DCE	TCE	PCE	1,1-DCE
Mar-13	34.1	11.0	2.39	73.5	14.7	5.17	54.4	3.44	9.23	48.6	2.20	3.33
Sep-13	37.5	11.7	3.14	86.4	14.5	6.22	59.6	3.71	7.52	39.0	2.63	2.50
Mar-14	35.5	10.3	2.84	76.2	13.5	4.84	44.0	2.99	6.18	45.6	2.86	3.01
Mar-15	33.8	9.39	2.68	81.6	12.3	4.39	42.2	2.80	5.74	48.1	2.51	2.84

2.4 TREATMENT GOALS

The minimum standard for treated water quality at the wellhead treatment systems is the MCL for each of the target COCs, which is consistent with the final Remedial Objectives set forth in the Final RI Report, Appendix AA (Terranext, 2012). The current MCL for each of the target COC's is provided in the following table.

Target COC	MCL (μg/L)
Trichloroethene (TCE)	5.0
Tetrachloroethene (PCE)	5.0
1,1-Dichloroethene (1,1-DCE)	7.0

The point of compliance (POC) sample ports (installed in the 14-inch discharge piping, located downstream of the treatment skids and immediately upstream of the receiver box for each treatment system, see **Figures 3-6**) is the location for demonstrating that each treatment system achieves these Treatment Goals.

3.0 SYSTEM DESCRIPTION

RID has selected a pre-engineered LGAC system, manufactured by Siemens Water Technologies, to treat the discharge from the impacted RID production wells. The selected LGAC systems, described in more detail in Section 4.3, are modular and consist of two (2) GAC pressure vessels, a treatment "skid", with a capacity of 1,000 gallons per minute (gpm, nominal) with Siemens stated maximum of 1,100 gpm. The treatment skids are installed on and anchored to concrete containment pads with 6-inch curbing and sumps. Each discharge structure is enclosed and sealed for volatilization control. Wellhead treatment will be conducted in a manner consistent with the ADEQ-approved remedial actions. Design/record drawings for the previously installed wellhead treatment systems are included as **Appendix A** (RID-89), **Appendix B** (RID-92), **Appendix C** (RID-95), and **Appendix D** (RID-114). Design/record drawings for the additional wellhead treatment systems that will be installed pursuant to ADEQ-approved remedial actions will be included to supplement this O&M Plan.

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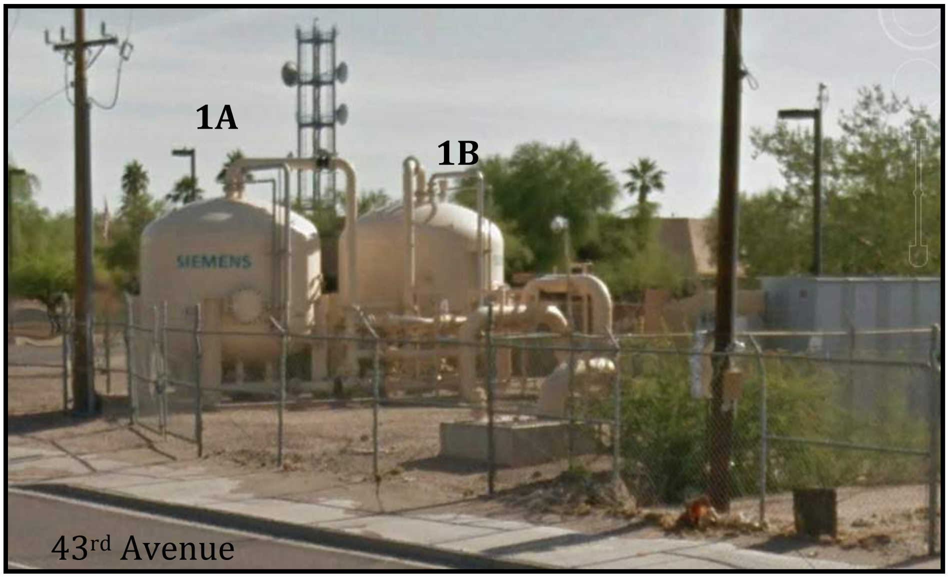
1. RID-89: Located on the east side of 51st Avenue, approximately ¼-mile north of Buckeye Road; the site area is approximately 4,500 square feet (ft^2). Based on nominal flow rate of 3,400 gpm, RID installed three skids.

   From the north (left) to the south (right), each pair of vessels (skids) are numbered 1, 2, and 3; with individual vessels labeled (again, north to south): 89-1A and 89-1B (skid 1); 89-2A and 89-2B (skid 2); and 89-3A and 89-3B (skid 3).

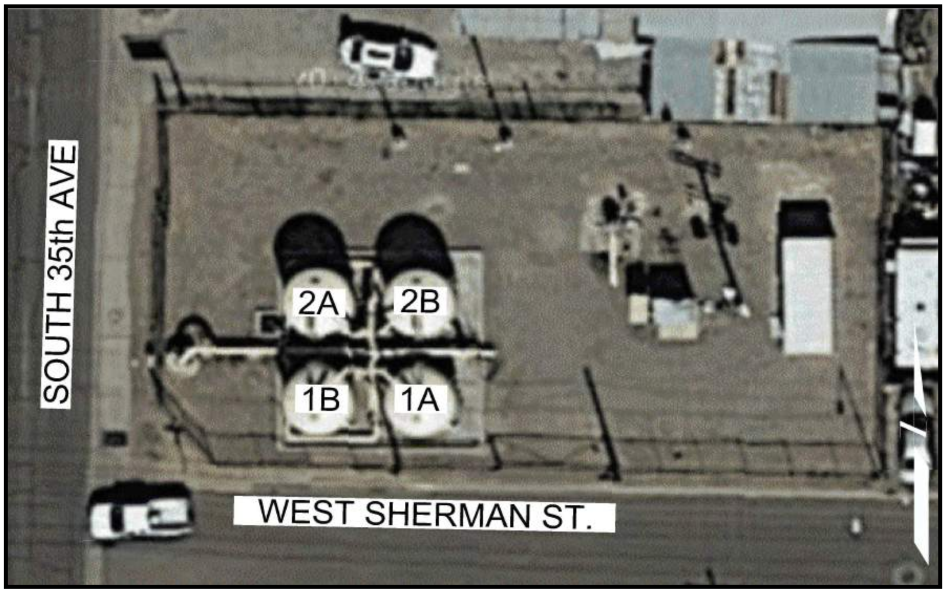
2. RID-92: Located on the east side of 43rde Avenue, approximately ¼-mile north of Buckeye Road; the site area is approximately 2,400 ft². Based on nominal flow rate of 1,400 gpm and limited available foot print, RID installed a single skid.

   Vessels are labeled 92-1A (west vessel) and 92-1B.



3. RID-95: Located on the northeast corner of Sherman Street and 35th Avenue, approximately ¼-mile north of Buckeye Road; the site area is approximately 6,900 ft^2. Based on nominal flow rate of 1,850 gpm, RID installed two skids.

   From south to north, skids are numbered 1 and 2; with vessels labeled: 95-1A (east vessel) and 95-1B for skid 1; and 95-2A (west vessel) and 95-2B for skid 2.



4. RID-114: Located at the southwest corner of 23rd Avenue and Van Buren Street; the site area is approximately 7,000 ft^2. Based on nominal flow rate of 2,500 gpm, RID installed three skids.

   From north to south, skids are numbered 1, 2, and 3; with vessels labeled: 114-1B and 114-1A (skid 1); 114-2B and 114-2A (skid 2); 114-3B and 114-3A (skid 3).

4.0 OPERATION AND MAINTENANCE

The following sections describe the specific details for operating and maintaining the wellhead treatment systems, including a notifications procedure during system operation upset events; and details for RID's well pumps, the selected LGAC treatment skids, wellhead treatment system operations, instrumentation and controls, and the sampling and analysis program.

4.1 SYSTEM OPERATION UPSET EVENT NOTFICATIONS

The Operator receives automated notifications (on his mobile phone) to alert in the event of certain control conditions described in detail in Section 4.5.9, and is required to respond, as appropriate, to each notification within 2 hours. The Operator will notify RID and Synergy in the event of significant process control change(s), problem(s) or failure(s). As soon as the issue(s) of the event are reviewed and fully understood, Synergy will notify ADEQ by telephone within 24 hours of operational changes made to the wellhead treatment systems, if the quality of the treated water could be affected, or if releases to the environment have occurred.

Deleted: (Spinnaker Holdings, LLC)

Contact information for the individuals to be notified by Operator/Synergy is included below:

Deleted: Spinnaker Holdings

Roosevelt Irrigation District
Donovan Neese, PE
Superintendent
Email: dneese@rooseveltirrigation.org
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Water Operations Manager
Email: kcraig@rooseveltirrigation.org
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On-Duty Water Master: (623) 386-2046

Agency Oversight
Scott Green
Arizona Department of Environmental Quality
Email: Green.Scott@azdeq.gov
Phone: (602) 771-1612

In accordance with A.A.C. R18-16-411(E)(4), this O&M Plan shall include "a process for the treatment system Operator to promptly notify potentially affected water providers of a failure of a key treatment system component that could affect the quality of a discharge of treated water."

Treated water from the wellhead treatment systems currently is exclusively discharged to RID canals and laterals for agricultural use. Consequently, there are no other potentially affected water providers within the WVBA Site that would be affected by a discharge of treated water in the event of significant process control issues or failures at any of the wellhead treatment systems. However, at such time in the future when RID plans to serve treated water to persons or parties for municipal and industrial end use, this O&M Plan will be revised to identify the affected water provider(s) and the process by which RID will promptly notify those water providers of any failure of a key treatment system component that could affect the quality of the discharge of treated water. The revised O&M Plan will be submitted for ADEQ approval at least 90 days prior to initiation of water delivery to the affected water provider(s).

4.2 WELL AND TREATMENT SYSTEM DETAILS

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Table 2 provides details for well construction (i.e., hole depth, screen intervals, units screened, casing total depth and casing diameters), historical depth to water and pumping water levels, and pumps/motors currently installed and operating at each wellhead treatment system site. The control strategy for each well pump is provided in Section 4.5.1. Following is a summary of normal operating values for each of the currently installed wellhead treatment systems. A similar description of the operating parameters for the additional wellhead treatment systems that will be installed pursuant to ADEQ-approved remedial actions will be included to supplement this O&M Plan.

RID-89

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	0.5 psi
Wellhead Pressure (Treatment)	16.5 psi
Flow Rate (Bypass)	3,200-3,300 gpm
Flow Rate (Treatment)	2,300-2,600 gpm
Skid 1 Post-Lead Vessel Pressure	12 psi
Skid 1 Effluent Pressure	2.0 psi
Skid 2 Post-Lead Vessel Pressure	12 psi
Skid 2 Effluent Pressure	2.0 psi
Skid 3 Post-Lead Vessel Pressure	11 psi
Skid 3 Effluent Pressure	1.5 psi

Notes:
psi = pounds per square inch
gpm = gallons per minute

RID-92

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	0.5 psi
Wellhead Pressure (Treatment)	21 psi
Flow Rate (Bypass)	1,400 gpm
Flow Rate (Treatment)	1,100-1,200 gpm
Skid 1 Post-Lead Vessel Pressure	2.0 psi
Skid 1 Effluent Pressure	1.0 psi

RID-95

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	1.0 psi
Wellhead Pressure (Treatment)	12.5 psi
Flow Rate (Bypass)	1,750 gpm
Flow Rate (Treatment)	1,500-1,600 gpm
Skid 1 Post-Lead Vessel Pressure	5.0 psi
Skid 1 Effluent Pressure	2.0 psi
Skid 2 Post-Lead Vessel Pressure	7.0 psi
Skid 2 Effluent Pressure	2.0 psi

RID-114

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	0.5 psi
Wellhead Pressure (Treatment)	11.5 psi
Flow Rate (Bypass)	2,400 gpm
Flow Rate (Treatment)	2,100-2,300 gpm
Skid 1 Post-Lead Vessel Pressure	7.0 psi
Skid 1 Effluent Pressure	2.0 psi
Skid 2 Post-Lead Vessel Pressure	7.0 psi
Skid 2 Effluent Pressure	3.0 psi
Skid 3 Post-Lead Vessel Pressure	6.0 psi

Skid 3 Effluent Pressure	2.5 psi

4.3 LGAC TREATMENT SKIDS

The wellhead treatment systems consist of Siemens HP-1220 LGAC treatment skids, each capable of treating a nominal flow of 1,100 gpm of water in series (lead-lag) configuration. The numbers of skids at each well site currently include: RID-89 (3), RID-92 (1), RID-95 (2) and RID-114 (3), for a total of 9 skids.

The LGAC treatment skids include the following standard design features:

- Down-flow configuration to facilitate backwash;
- Integrated piping (8-inch schedule 40 carbon steel) with cast iron gear/wheel butterfly valves with EPDM seats, configured to allow series, parallel or vessel-isolation flow;
- Systems operate utilizing existing well equipment to pump the impacted groundwater through the LGAC vessels for treatment and periodic backwash;
- Equipped with sample ports at the skid influent, 25%, 50% and 75% of GAC bed depth, and vessel effluent to enable monitoring of mass transfer zone and breakthrough;
- 20,000 pound carbon capacity in each carbon steel vessel (7,520 gallon volume);
- Operating flow rate of 1,100/2,200 gpm (series/parallel) per skid and 1,000 gpm backwash flow rate (higher flow rates can be achieved but empty bed contact time would decrease proportionally);
- Integrated GAC transfer piping (4-inch Schedule 10 304L stainless steel); and,
- Vessels and piping are rated to 125 psi and burst discs are integral to the piping to safely release and divert water in the event of over-pressure.

During 2013 and 2014, critical maintenance work was needed at all four (4) current wellhead treatment systems (i.e., all 18 vessels) to replace corroded piping (4-inch, Schedule 10 304L stainless steel GAC fill and removal lines), which were covered under warranty. Similar defects have been observed on the Siemens GAC equipment installed at the North Indian Bend Wash federal Superfund Site. Each pipe was removed and replaced by Siemens' (now Evoqua Water Technologies) contractor Smyth Industries, of Tucson, Arizona with the GAC fill lines primarily replaced in 2013 and the GAC removal lines replaced on 10 of 18 vessels during carbon change-out activities from June through October 2014. The remaining GAC removal lines will be replaced when carbon change-out activities are needed on the 8 currently remaining vessels.

4.4 SYSTEM OPERATION

General system operation for each LGAC skid includes operation in treatment mode, bypass mode, and a modified treatment mode to facilitate LGAC change-outs and/or backwash. Each skid is configured for series (or lead-lag) operation for normal treatment mode, but are capable of parallel or single vessel operation, as necessary, to facilitate maintenance activities.

Operational performance data will be continuously monitored and collected on a monthly basis using the instrumentation and supervisory control and data acquisition (SCADA) system described in Section 4.5.6.

An Operation & Maintenance Manual (prepared by Siemens) for the pre-engineered LGAC skids is included as **Appendix E**, and provides equipment details/specifications including: standard procedures to operate the treatment skids (i.e., start-up, carbon changes, backwashing), troubleshooting, system monitoring, shutdown and emergency procedures, maintenance, lists of scheduled materials (with part numbers) on the drawings in Section 8.0, and specifications for the vessels (i.e., drain system, valves, burst disks, spray nozzles, pressure gauges, and interior/exterior coatings). Although the Operation & Maintenance Manual specifically identifies “Well Site 95”, the same Manual is applicable to the equipment and operations for the other three (3) current wellhead treatment systems (RID-89, RID-92 and RID-114). Therefore, only one Manual is included as part of this O&M Plan.

A flow diagram and valve sequence chart are also included in the Siemens Operation & Maintenance Manual and on **Figures 3-6**. Each valve associated with the HP-1220 systems has been clearly labeled in the field to help the Operator when making changes to the operation of the treatment systems.

4.4.1 Treatment Mode

Each LGAC skid is operated in conjunction with RID’s pumping schedule with cessation of treatment during well maintenance activities, treatment system maintenance activities (requiring system shut-down), lack of adequate funds from third parties or cost recovery actions or unanticipated failures (including but not limited to: power outages, critical alarms, or equipment malfunctions).

4.4.2 Bypass Mode

Should it become necessary to shut off any of the treatment trains, and RID requires the flow from that well, the untreated flow may be temporarily bypassed (in part or in whole) around the treatment system and discharged directly into the existing receiver box until treatment can resume (utilizing the 3-way valve, see Section 4.5.4).

The notification procedure in Section 4.1 shall be followed if a treatment system is changed from treatment mode to bypass mode (full bypass) due to a system upset event. Other

operational changes that require partial bypass, including carbon change-out activities or changes in RID's water demand that require full bypass, for example, will be documented in the Monthly Progress Reports (Section 6.2).
There is a routine occurrence when operation in partial bypass mode is necessary at the RID-92 wellhead treatment system. Since there is only one treatment skid at RID-92, partial bypass is necessary during carbon change out activities to fluidize the GAC for removal and refilling activities, and backwashing. Partial bypass is necessary in this case to prevent excessively high flow rate during backwash, which could result in possible loss of GAC. Since all other treatment systems utilize two or three treatment skids, this mode of routine partial bypass is only necessary at the RID-92 wellhead treatment system.

During full or partial bypass operation, the SCADA system is still functioning and the change in flow path is shown on the control screens and captured by data acquisition. When this occurs, the wellhead pressure will decrease and flows will increase (due to reduced pressure head). During full bypass mode operation, pressure differential across the lead and lag vessels goes to zero, and therefore, no alarms are triggered.

4.4.3 LGAC Change-Outs and Backwash

LGAC bed life will be assessed/monitored in each treatment system by sampling and analysis for target COCs as described in Section 4.6. Carbon change-outs will be scheduled based on COC concentrations as determined in weekly water quality analytical results. Trigger levels have been established based on the breakthrough performance from the last several years of treatment system operation at each of the four (4) current treatment systems, as described below.

Each of the four treatment systems has a unique breakthrough profile that is dependant on the mixture and relative concentrations of the COC's as well as the flow rate through each system. Breakthrough curves at RID-89 and RID-114 treatment systems are very similar, however, due to the fact that both have relatively low concentrations of 1,1-DCE in the pumped groundwater (less than 3 μg/L). Breakthrough curves are also similar for treatment systems at RID-92 and RID-95 where pumped groundwater contains higher concentrations of 1,1-DCE, between 6 and 8 μg/L.

The MCL (and treatment goal) for 1,1-DCE is 7 μg/L; therefore, exceedance of this treatment goal at RID-89 or RID-114 is extremely unlikely with such low influent concentrations. There is the potential, however, for exceedance of this treatment goal at RID-92 and RID-95. Therefore, two sets of trigger levels have been established.

Trigger levels for managing GAC replacements include both "alert" levels and "action" levels. Alert levels are in place to prompt a heightened awareness and review of the water quality data trends to ensure that no significant changes have occurred (e.g. abrupt rise in influent concentration) and to provide advanced consideration in change-out planning. Action levels are in place to trigger mandatory initiation of GAC change-out.

These trigger levels apply to the COC concentrations noted in the water quality analytical results for the samples specified as follows:

RID-89 and RID-114

Alert Level:	**3.0** μg/L	1,1-DCE	Influent Sample
	4.0 μg/L	1,1-DCE	Point of Compliance
Action Level:	**2.5** μg/L	TCE or PCE	Point of Compliance **(1/2 MCL)**
	6.5 μg/L	1,1-DCE	Point of Compliance

RID-92 and RID-95

Alert Level:	**1.5** μg/L	TCE or PCE	Point of Compliance
	2.5 μg/L	1,1-DCE	Point of Compliance
Action Level:	**2.5** μg/L	TCE or PCE	Point of Compliance **(1/2 MCL)**
	3.5 μg/L	1,1-DCE	Point of Compliance **(1/2 MCL)**

Again, "alert levels" are established as an early warning indicator whereas "action levels" trigger mandatory initiation of GAC change-out. GAC may be replaced prior to exceeding an action level, however, at the discretion of the operator for reasons such as to facilitate scheduled or unscheduled maintenance or in preparation for an extended shutdown (particularly with those beds near exhaustion).

A carbon change-out with reactivated GAC will be scheduled according to the conditions prescribed. When such a condition is observed, the lead vessel of the skid with the highest target COC concentration in the Mid-Skid sample will be scheduled for the change-out unless the change-out is initiated to facilitate maintenance on a different vessel[2].

During each carbon change-out, the lag vessel will be reconfigured as lead and the spent GAC removed from the exhausted vessel and replaced with fresh reactivated GAC. During removal

[2] Currently, the RID-92 wellhead treatment system only has a single skid.

and replacement of the spent GAC from the exhausted vessel, the remaining vessel will continue to treat the flow on a stand-alone basis (i.e., single pass). In some instances, it may be necessary to isolate an entire skid and/or switch to partial or full bypass to facilitate maintenance activities.

Following recharging of the exhausted vessel, the recharged vessel will be backwashed to remove fines, left to soak for approximately 24 hours to remove entrained air, and put back into service as the lag vessel and remain in that configuration until the lead vessel requires a carbon change-out. Backwash will be conducted at a flow of approximately 1,000 gpm (using treated water conveyed from the new lead vessel while operating in stand-alone basis) and backwash water will be diverted from the backwashed vessel directly to the discharge receiver box.

Based on carbon change-out frequencies for each of the current wellhead treatment systems[3] to date, the estimated change-out schedule per vessel at each site is included below:

- RID-89: 4-5 months of operation
- RID-92: 2-3 months of operation
- RID-95: 2-3 months of operation
- RID-114: 5-6 months of operation

4.5 INSTRUMENTATION AND CONTROLS

The wellhead treatment systems are equipped with instrumentation and controls (I&C), designed and integrated by Vertech, that provide real-time monitoring of key performance parameters of system operation. The I&C also enables remote operation and monitoring of system operations and provides alarm notification for key process and control parameters. Control System record drawings for the current wellhead treatment systems are included in **Appendix A** (RID-89), **Appendix B** (RID-92), **Appendix C** (RID-95), and **Appendix D** (RID-114).

Instrumentation is included to monitor:

- Well pump run status;
- Well discharge and bypass flow rates (instantaneous and totalized);
- Flow to each treatment skid (instantaneous and totalized);
- Wellhead pressure; and,
- Differential pressure across each treatment skid.

Controls/alarms are included for:

[3] These systems currently only operate 7-8 months per year based on RID's historical operations.

- Pump start/stop;
- Bypass flow;
- Low flow at each treatment skid; and,
- Water level in sumps and sump pump start/stop.

These I&C nodes are integrated into a SCADA system that allows for remote control of the systems as well as continuous monitoring capabilities and data storage to document key aspects of treatment system operations and demonstrate the level of reliability required to ensure the successful remediation of the groundwater supply (i.e., to achieve Treatment Goals) and the protection of public health.

The following sections describe the various I&C components, including O&M requirements for each. Equipment manuals for each component are included in **Appendix F**.

4.5.1 Well Pumps

The well pumps for the wellhead treatment systems convey groundwater through the treatment skids (treatment mode) or directly to the discharge structure (bypass mode). The pumps can be controlled manually from the local Operator Interface Terminal (OIT), mounted to the front of the Remote Terminal Unit (RTU) control panel, or operated remotely from the OIT in the control room at RID-95 (or via remote connection to the OIT in the control room). The OIT in the control room can control operations for all four (4) current wellhead treatment systems.

System Start-Up and Shut Down Procedures

Prior to start-up of each wellhead treatment system, the Operator shall inspect the system components for potential problems (including water accumulation in the containment area sump[s]), inspect piping for signs of leaks, verify all control and isolation valves are positioned properly, and acknowledge/clear any alarms on the OITs. The Operator will check to see if the pump switch at each site is in "Auto" mode inside the motor control center (MCC) cabinet.

- Well pumps are started manually by pressing the "Main Pump Start" push button on the local OIT or the OIT located in the control room (or via remote connection to the OIT in the control room).
- Following start-up, the Operator will monitor the treatment systems for a minimum of 15 minutes to verify proper operation.
- Each well pump will run continuously until manually stopped by pressing the "Main Pump Stop" push button on the local OIT or at the OIT located in the control room (or

via remote connection to the OIT in the control room). Well pumps can also be manually stopped by switching from Auto to OFF using the local controls in the switchgear cabinet adjacent to the well.

Shut Down Conditions

- Each well pump will stop automatically in the event of a motor overload condition. The pump will need to be restarted manually at the MCC cabinet after the overload relay for the pump motor starter is reset.
- In the event of a power failure/outage while the pump is running (see Section 4.5.9), the pump will attempt to restart one time. If the attempt fails, the pump will need to be restarted manually at the local OIT or remotely at the control room after the SCADA computer is restarted.
- In the event of an overload condition with the pump motor starter, an alarm will be displayed on the OIT at the local control panel and at the OIT in the control room, and the Operator will be notified.
- In the event of a low-low flow rate critical alarm at a treatment skid, the Operator will be notified and the well pump will automatically shut off at that site. For this critical alarm, the Operator will follow the system upset notifications procedure described in Section 4.1.
- When water (e.g., rain water or process water) accumulates in a sump, a high-level switch alarm will result when water reaches the first float alarm point. The Operator will be notified and the sump pump(s) will start automatically to discharge the water until the water level drops to below the first float alarm point. If the accumulation of water reaches the second float alarm point, a high-high critical alarm will result in another notification to the Operator, and the well pump will automatically shut off. For this critical alarm, the Operator will follow the system upset notifications procedure described in Section 4.1.

4.5.2 Flow Meters

Manufacturer/Model	Size	Sensor/Transmitter Type
Siemens, Sitrans F M Magflo®	8”& 14”	MAG 5100W/MAG 5000

- 8-inch flow meters installed one per treatment skid to measure instantaneous and totalized flow of raw groundwater (i.e., influent).

- 14-inch flow meters installed one per well site on the bypass piping. At RID-89, RID-92 and RID-114, the flow meter measures well discharge flow in both treatment and bypass modes (instantaneous and totalized values). At RID-95, the 14-inch flow meter only measures bypass flow (instantaneous and totalized) due to operational/mechanical constraints within the treatment system concrete pad. Treatment flow at RID-95 is measured by the two 8-inch flow meters, which are combined to derive the total well discharge flow rate.
- If a treatment skid flow rate at a site falls below the low-low flow rate critical alarm value, (summarized in Section 4.5.6), the Operator will be notified and the well pump at that site will automatically shut off.

4.5.3 Pressure Transmitters

Manufacturer/Model	Range	Order No.
Siemens, Sitrans P200	0-200 psig	7MF1565-4CB

- At each site, one pressure transmitter is located upstream of the 3-way valve to monitor wellhead pressure (see **Figures 3-6**).
- At each site, one pressure transmitter is located on the effluent piping of each treatment skid to monitor effluent water pressure and differential pressure across the vessels (see **Figures 3-6**). If the differential pressure (calculated from the values measured at the transmitter located immediately downstream of the wellhead and the transmitter at the effluent piping of each treatment skid) increases to the high differential pressure value of 25 psi (which could indicate solid deposits accumulating in the carbon bed, for example), an alarm will be displayed on the OIT and the Operator will be notified. This is not a critical alarm, and therefore, will not automatically shut off the well pump.

4.5.4 3-Way Valves

Manufacturer/Model	# of Positions	Power
VSI, Series 1000 Electric Actuator [1200]	2 (on/off)	AC 120V/240V AC24

- Each wellhead treatment system includes one (1) 3-way valve that can be controlled manually at the valve (using an Allen handle at the manual override location), or using the electric actuator through the local OIT mounted to the front of the RTU control panel at each site, or remotely from the OIT in the central control room (or via remote connection to the OIT in the control room). In normal operation, the valve will be closed on the bypass piping and open on the influent piping to each treatment skid.

- To prevent water hammer, power-assisted closing/opening of valve is paced to occur over a 120-second period (i.e., over 2X safety factor based on the manufacturer's specifications) when changing from normal operation to bypass mode, or from bypass mode to normal operation.
- For temporary changes in flow between treatment and bypass, the Operator may manually open/close the bypass valve until the desired flow rates are obtained (using an Allen handle at the manual override location). The manual opening/closing of the bypass valve is conducted at a controlled rate to prevent water hammer.

4.5.5 Sumps and Level Switches

Manufacturer/Model	# of Floats	Order No. / Switch Type
Dwyer, Mercoid Series FSW2 Free-Floating Level Switch	2 (high/high-high)	FSW2-ONPN-20 / SPST NO FSW2-CNPN-20 / SPST NC

- The concrete pads at each site are constructed with approximate 6-inch berms along the pad perimeter to contain and prevent release of water and the pads slope slightly towards the collection sump(s) to facilitate collection and detection of any incidental rainfall or system leakage.
- The wellhead treatment systems at RID-92 and RID-95 each have one sump equipped with two (2) level sensors/switches.
- The RID-89 and RID-114 wellhead treatment systems each have two sumps, both equipped with two (2) level sensors/switches that operate independently.
- Each sump is covered by a grate conforming to Maricopa Association of Governments (MAG) detail 539.
- The Operator will inspect each sump on a weekly basis for the accumulation of water and if present, will determine the source.
- When water (e.g., rain water or process water from sampling or maintenance activities) accumulates in a sump, a high-level switch alarm will result when water reaches the first float alarm point. The Operator will be notified and the sump pump(s) will start automatically to discharge the water until the water level drops to below the first float alarm point. If the accumulation of water reaches the second float alarm point, a high-high critical alarm will result in another notification to the Operator, and the well pump will automatically shut off. For this critical alarm, the Operator will follow the system upset notifications procedure described in Section 4.1.
- The water contained in the sump will be discharged via 1 ½" to 2" galvanized steel piping by a ¾ horsepower pump (rated for 50 gpm) to the discharge structure/receiver box at the well site.

4.5.6 SCADA System

Each wellhead treatment system site is equipped with a wireless transceiver that allows communication with the control room at RID-95, which serves as the central hub for the SCADA system. Screen shots of the SCADA system are included in **Appendix G**. A summary of the SCADA system alarm conditions is included below. The low-low flow rate critical alarm value for each skid is calculated as 75% of the flow rate from the well divided by the number of treatment skids for that site. The Operator will be notified for each alarm condition. Other critical and non-critical conditions are as described in previous sections.

Condition	Alarm Value
RID-89 Low-Low Flow Rate - 3 Treatment Skids (Critical)	75% of the well flow rate divided by the number of treatment skids
RID-92 Low-Low Flow Rate - 1 Treatment Skid (Critical)	
RID-95 Low-Low Flow Rate - 2 Treatment Skids (Critical)	
RID-114 Low-Low Flow Rate - 3 Treatment Skids (Critical)	
Treatment Skid Differential Pressure (Non-Critical)	25 psi
High Level in Sump (Non-Critical)	First float
High-High Level in Sump (Critical)	Second float
High Temperature (Non-Critical)	120°F

4.5.7 Temperature Sensors

Manufacturer/Model	Product No.
Siemens, 4-20 mA Room Temperature Sensor	536-753 (20 to 120°F)

- Temperature sensors are installed at all the wellhead treatment systems.
- The sensors monitor the cabinet temperature containing the control hardware and the temperature inside of the RID-95 control room. If the alarm value 120 degrees Fahrenheit (°F) is exceeded, the Operator will be notified, but no change in the operational status of the system will occur.

4.5.8 Site Security

Site security at each wellhead treatment system site includes:

- New lighting fixtures that comply with local night sky ordinance.
- New wrought-iron fencing and access gates set-up with electronic sensing alarms (except at RID-92).
- Keys for the locks at each well site access gate will be provided to approved/authorized personnel only (Note: some locks are daisy-chained to allow access by Salt River Project personnel to read the electrical meters).
- Secure access to electrical equipment.
- Cameras for 24-hour site surveillance. Cameras can be remotely operated (including pan/zoom capability) on the SCADA computer to assist the Operator in rapid assessment of system conditions.

4.5.9 System Operation Upset Events

An unscheduled shutdown of the wellhead treatment systems may occur due to various reasons, which include (but are not limited to) the following:

- Power Outage – power supply outages may occur as a result of lightning storms, downed power lines, down transformer, etc. If any of the treatment systems have a loss of power, the system will automatically restart the well pump one time, in bypass mode. In the event of a power outage, a back-up power supply will allow for the SCADA system to remain operational, and the Operator will be notified of the alarm. The Operator will need to physically visit the treatment system to inspect the cause of the alarm, coordinate restoration of power supply at the site, and restart the treatment system.

- Heavy Rain – as indicated in Section 4.5.5, each sump is equipped with a two-level sensor/switch. In the event that a heavy rainstorm causes accumulation of rain water in a sump to reach the second float (triggering a high-high critical alarm), the Operator will be notified and the well pump will automatically shut off.

- Critical Alarms – there are a number of alarm conditions (summarized in Section 4.5.6), that when triggered, will result in an automatic notification to the Operator. However, two types of critical alarms (i.e., low-low flow rate for each treatment skid and a high-high level in a sump), will automatically shut off the well pump.

Please refer to Section 4.1 for notification procedures for wellhead treatment system upset events.

4.6 SAMPLING AND ANALYSIS

This section provides the methods and procedures to collect and analyze wellhead treatment system samples.

4.6.1 Purpose of Sampling and Analysis Program

The goal of the sampling and analysis program is to collect data to:

- Determine compliance with the water quality Treatment Goals for the target COCs;
- Determine when LGAC bed breakthrough/exhaustion occurs and LGAC change-out is needed; and,
- Determine the approximate mass of target COCs being removed at each wellhead treatment system.

4.6.2 Frequency and Locations of Sampling

The proposed data collection/sampling programs are presented in the matrix below. The location and frequency of each sample will be conducted for each of the individual LGAC treatment skids. Sampling frequency and locations refer only to the "lead" vessel except where noted.

Wellhead Treatment System Sampling Program Matrix

LOCATION	FREQUENCY
Influent Sample Port @ Wellhead	Weekly
	Monthly*
Mid-Skid Sample Port	Weekly
	Monthly*
Point of Compliance (POC)	Weekly

The asterisk next to each "Monthly" indicates that a change to this frequency will be based on an evaluation of "Weekly" data and may be changed after the treatment system reaches steady-state (if agreed to in advance by ADEQ). Sampling will revert to "Weekly" should significant variation or unanticipated results be observed.

The POC sample ports (installed at the 14-inch discharge piping, located downstream of the treatment skids and immediately upstream of each receiver box, see **Figures 3-6**) will be the location for demonstrating that the treatment system achieves the Treatment Goals for the target COCs described in Section 2.4. Field quality control (QC) samples will be collected as described in Section 4.6.4.

4.6.3 Sampling Methods

The following section provides details regarding the methods that will be used for the wellhead treatment system sampling program. Sampling will be conducted consistent with the provisions of the Health and Safety Plan, included as **Appendix H**.

<u>Sampling Equipment & Procedure</u>

Prior to sample collection, each sampling port will be purged for approximately 15-30 seconds to remove any stagnant water (i.e., non-representative water). Purge water from the influent and effluent sample ports will be collected in a two (2) gallon bucket, and will be disposed within the treatment system concrete containment structure.

Each water quality sample will be collected in a set of two (2) 40-milliliter volatile organic analysis (VOA) vials preserved with 1:1 hydrochloric acid (HCl). Samples will be collected with zero headspace. Each VOA vial will be tilted to approximately 45 degrees of vertical, and filled using a low flow rate (i.e., approximately 250 milliliters per minute of sample). The vial will be filled to the brim and then, using the cap, a small amount of water shall be added until a convex meniscus is formed. The vial will then be capped, turned upside down, and tapped to verify no headspace. Samples will be stored in a cooler with wet ice at 4° Celsius (C), ± 2°C, and hand delivered to the analytical laboratory.

4.6.4 Analytical Methods and Procedures

Samples will be analyzed following protocols that include quality control (QC) provisions and sample documentation and management practices as described in the following sections.

<u>Sample Analyses</u>

Water samples will be analyzed for VOCs following EPA Method 8260B and submitted to Airtech Environmental Laboratories (AEL) of Phoenix, Arizona. AEL is an environmental testing laboratory certified by ADHS under license number AZ0740. AEL will analyze for the six (6) WVBA Site COCs. The reporting limit for each COC will be 0.5 micrograms per liter.

Data quality control practices will be in accordance with the AEL standard operating procedure (SOP) for analysis of VOCs by EPA Method 8260B (**Appendix I**). Standard quality control requires analysis of a Laboratory Control Sample (LCS), LCS duplicate, internal standard, and surrogate analytes with each sample set. The 8260B method requires analytical accuracy to fall within a series of ranges of percent recoveries for internal standards and surrogates (see **Appendix I**). Laboratory duplicates must be less than or equal to 20 relative percent difference (RPD). Data quality control outside of these limits will be re-run if possible, or appropriately flagged with the reported results.

Quality Control

Quality control measures will be employed to evaluate both the field sampling procedures and techniques as well as the laboratory procedures and performance of instrumentation.

Field QC samples (including trip blanks and field duplicates) will be collected to help evaluate conditions resulting from field conditions and activities. Field QC samples may be used to evaluate variability in environmental sampling and analysis of organic contaminants.

Field duplicate samples will be collected and treated independently of its counterpart in order to assess field sampling procedures and laboratory precision and accuracy, through comparison of the results, and collected at a frequency of one (1) per sampling event. Duplicate samples will be preserved, packaged, and sealed in the same manner as the primary samples. A separate sample number and identification will be assigned to the duplicate, and it will be submitted blind to the laboratory. Identity of the duplicate sample will be recorded on the Weekly Operation and Maintenance Inspection Form (**Appendix J**).

Trip blank samples are used to determine if VOC water samples have been contaminated during transport from the field to the lab. The trip blanks are prepared by the laboratory by filling a VOA vial head-space free with organic free water, preserved with 1:1 HCl, labeled as "Trip Blank" or "TB" with the preparation date included on the custody seal. Trip blanks will be included in each cooler used to transport water samples to the laboratory. The results of the trip blanks are a key aspect of the overall QC system for the sampling program, and will be included in the analytical results report.

Laboratory quality control samples are certified standards analyzed by the laboratory (including matrix spike samples and duplicates) to demonstrate accuracy on a daily basis. Since samples to be used as matrix spikes are randomly selected by the laboratory analyst after receipt of samples, it is understood that such analyses may or may not include samples from any given sampling event or location.

Laboratory procedures will be evaluated using field duplicate samples, matrix spikes and other internal procedures defined by the analytical method and analytical laboratory.

Sample Documentation and Management

Chain-of-custody records are completed for each sampling event. The chain-of-custody record will be completed as samples are collected. An example chain-of-custody record for AEL is provided as **Appendix K** and will accompany the samples to the laboratory. Information to be entered on each chain-of-custody record includes:

- Project name
- Project manager/contact person
- Printed name of sampler and signature
- Date and time of collection
- Sample matrix identification
- Number of containers collected for each sample
- Sample identification
- Analyses requested
- Turn-around-time requested
- Dates of possession
- Name and signature of person relinquishing samples
- Date of sample receipt
- Time of sample receipt
- Name and signature of person receiving the samples
- Remarks pertinent to sample collection, preparation, preservation, and analyses

Samples will be submitted as soon as possible (i.e., on the date of sampling) to AEL with requested turnaround time of five (5) days and VOC analyses following EPA Method 8260B, which has a hold time of 14 days.

All documentation will be made in indelible ink. Corrections will be made by drawing a line through the error and entering the correct information. Both the error and the correct information must be legible. The person making the correction will initial the document where changes are made.

5.0 SPENT GAC MANAGEMENT

For each wellhead treatment system site, spent GAC must currently be profiled every two years by the carbon vendor. Synergy will coordinate the profiling process, contacting the carbon vendor a minimum of six weeks prior to an anticipated carbon change-out so that a grab sample of spent GAC can be collected and analyzed. The grab sample shall be collected by the carbon vendor using a 16-ounce glass jar (or similar) by accessing the 14-inch by 18-inch elliptical man-way located at the top of each vessel (see Section 8.0 of the Siemens O&M Manual in **Appendix E**). Following satisfactory completion of the profiling process, spent GAC can be removed and transported off-site to a reactivation facility provided the profile indicates the GAC as non-hazardous. All historical profiles have indicated spent GAC from the wellhead treatment systems were non-hazardous. All profile records will be maintained in the Field Office at RID-95.

6.0 DOCUMENTATION AND REPORTING

This section includes the ongoing, periodic documentation and reporting necessary for effective monitoring of the wellhead treatment systems.

6.1 WEEKLY INSPECTION FORMS

Inspections will be conducted once per week to monitor the operational and physical conditions at each wellhead treatment system. A blank inspection form is included as **Appendix J**, and provides for collecting data related to water flow rates; operating pressures at the wellhead and across the treatment vessels, alarms, and equipment inspections and maintenance/repairs. The Operator will complete the form during each inspection. All inspection data and information will then be uploaded to the operations database for the wellhead treatment systems. The inspection form will be reviewed annually (at a minimum) and updated as appropriate.

6.2 MONTHLY PROGRESS REPORTING

For each month that the wellhead treatment systems are in operation, a Monthly Progress Report will be prepared to document remedy progress. RID will provide ADEQ's Remedial Projects Unit with one (1) hardcopy and one (1) electronic copy of each Report by the 15th of the month that follows the reporting period. An example of a typical Monthly Progress Report (excluding copies of the final laboratory reports) is provided as **Appendix L**. Each Monthly Progress Report will include the following, at a minimum:

- Approximate mass of target COCs removed and groundwater volume treated during the reporting period, and cumulative total of target COCs removed and groundwater volume treated since system start-up for each treatment system and total for all sites;
- Tabular summary of wellhead treatment system samples collected and analytical results for the reporting period;
- Copies of final laboratory reports for the reporting period;
- Operational hours/percentage for each wellhead treatment system during the reporting period;
- Dates of carbon change-outs conducted during the reporting period;
- Summary of any malfunctions which caused the wellhead treatment systems to be offline during the reporting period;

- Summary of the maintenance activities performed to correct those malfunctions during the reporting period;
- Summary of system operation upset events (see Section 4.1) reported to ADEQ during the reporting period; and,
- Copies of the weekly inspection forms during the reporting period.

The most recent Monthly Progress Reports (without voluminous analytical laboratory results) are available on the West Valley Groundwater Cleanup Coalition website (http://www.wvgroundwater.org), under the "Project Documents" tab.

7.0 KEY CONTACTS LIST

Key contacts for the wellhead treatment systems include:

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ATTACHMENT 2

Synergy Environmental, LLC

OPERATION & MAINTENANCE PLAN

RID WELLHEAD TREATMENT SYSTEMS

JANUARY 2016
Revision 7

WEST VAN BUREN AREA WQARF SITE
PHOENIX, ARIZONA

Prepared for: **Arizona Department of Environmental Quality**

Prepared by: **Synergy Environmental, LLC**

On Behalf of: **Roosevelt Irrigation District**

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLES

Table

FIGURES

Figure

APPENDICES

Appendix

TABLE OF CONTENTS (Continued)

APPENDICES (Continued)

January 2016, Revision 7

OPERATION AND MAINTENANCE PLAN – RID WELLHEAD TREATMENT SYSTEMS

WEST VAN BUREN AREA WATER QUALITY ASSURANCE REVOLVING FUND SITE

1.0 INTRODUCTION

Groundwater in the West Van Buren Area Water Quality Assurance Revolving Fund Site (WVBA Site) contains hazardous substances, principally volatile organic compounds (VOCs) that have impacted Roosevelt Irrigation District (RID) production wells. Arizona Department of Environmental Quality (ADEQ) acknowledged that the RID wells that extract and discharge VOC-contaminated groundwater to surface water are the major outflow of contamination from the Site (Terranext, 2012). It was further noted that the RID canals provide a potential route of surface water contaminant migration within and downstream of the WVBA Site.

RID relies on the wells within the WVBA Site to meet critical water supply needs and, consequently, submitted a Work Plan for conducting an Early Response Action (ERA) to restore a portion of these impacted wells for current and reasonably foreseeable beneficial uses, including future use as a drinking water source (Montgomery & Associates, 2010), as provided in the Arizona Water Quality Assurance Revolving Fund Program:

- Arizona Revised Status (ARS) §49-282.06.B.4.b; and,
- Arizona Administrative Code (A.A.C.) R18-16-405.

Although the ERA was designed to capture and treat hazardous substances primarily as a well protection and water supply initiative, the action was also proposed to mitigate public exposure associated with the uncontrolled release of VOCs in groundwater pumped by RID from the WVBA Site. Air and water sampling was conducted in accordance with the *Public Health Exposure Assessment and Mitigation Work Plan* (Synergy Environmental [Synergy]*, 2011a)*. The resulting data enabled review of the potential insight into the fate and transport of these contaminants (Synergy, 2011b). The assessment compared the sampling results to health-based guidelines to make a screening-level determination as to whether these substances pose a significant risk to public health and provide data to assist in developing detailed designs for engineering controls to limit uncontrolled VOC emissions.

Consistent with the Task 4-Engineering Design Study required by the ADEQ in the ERA conditional approval letter of June 24, 2010 (ADEQ, 2010), RID submitted a proposal to construct and operate a pilot wellhead treatment system at RID-95 and additional wellhead treatment at select sites (Synergy Environmental, 2011c). In a letter dated September 2, 2011, ADEQ authorized implementation of RID's proposed Pilot System initiative (ADEQ, 2011).

Before initiating treatment at the additional well sites (i.e., RID-89, RID-92 and RID-114) under RID's proposed Pilot System initiative, RID agreed to prepare and submit a near-term assessment, following one month of system operation, to consider the technology, system design and site-specific engineering and operation controls to determine the effectiveness of liquid-phase granular activated carbon (LGAC) and the reliability of the system as designed/operated to provide safeguards to protect public health in the event of system failures (in accordance with A.A.C. R18-16-411). The *1-Month Technology/Design Demonstration Report: RID-95 Pilot System* (Synergy, 2012a), describes the successful completion of the assessment period, which demonstrated the reliable operation of the treatment system without identification of any design or operational issue that could reasonably endanger public health.

On July 17, 2012, a Modified ERA Proposal (Synergy, 2012b) was submitted to ADEQ as an addendum to the original ERA Work Plan, dated February 3, 2010 and conditionally approved by ADEQ on June 24, 2010 (ADEQ, 2010). The addendum was proposed in order to provide a more cost effective approach to accomplish the goals of the ERA remedial action. The Modified ERA Proposal provided an optimized design approach to address the highest contaminated RID wells located in the WVBA Site and incorporated information and insights gained from the investigations prescribed by ADEQ in the original ERA Work Plan letter (Tasks 1 through 4) and from the Pilot System initiative. Based on the detailed consideration and analysis of this new information, RID proposed substantive modifications to the original ERA Work Plan, which included utilizing a combination of treatment and blending to effectively reduce the concentration of VOCs from several additional, lower concentration wells resulting in lower volume of water being directly treated while providing a higher total volume of groundwater that is remediated to meet applicable federal maximum contaminant levels (MCLs). On October 19, 2012, Synergy submitted the Modified ERA Work Plan to ADEQ, which incorporated applicable content from the original ERA Work Plan and from the Modified ERA Proposal (Synergy, 2012c). In a letter dated February 1, 2013, ADEQ conditionally approved the Modified ERA Work Plan (ADEQ, 2013).

In July 2014, RID submitted a Feasibility Study Report (Synergy, 2014a) to ADEQ pursuant to the RID Feasibility Study Work Plan approved by ADEQ on July 16, 2013. The RID Feasibility Study

Report was prepared to evaluate possible groundwater alternative remedies and determine a proposed groundwater remedy for the WVBA Site that would address all RID wells that would not be fit for their current and reasonably foreseeable end uses due to the releases of VOC contaminants (in accordance with ARS §49-282.06.B.4.b). Remedial strategies and measures were developed to meet all applicable remedial action criteria in ARS §49-282.06 and A.A.C. R18-16-407 and formulated into possible groundwater alternative remedies that are capable of achieving the Remedial Objectives established by ADEQ for the WVBA Site. RID submitted a revised Feasibility Study Report (Synergy, 2014b) to ADEQ on November 26, 2014 that addressed comments from ADEQ and was subject to public comments and a public meeting. ADEQ approved RID's Feasibility Study Report, including the proposed remedial action, on April 13, 2015 (ADEQ, 2015).

Consistent with the ADEQ letter dated September 2, 2011, that agreed with implementation of the Pilot System initiative, the *Long-Term Operational Assessment Report, RID-95 Wellhead Pilot Treatment Systems* documented the long-term performance of the wellhead treatment systems in order "…*to determine whether well head treatment can be an effective treatment technology*…(that results in)…*reducing the cost of the final remedy*…*and/or mitigating contaminant exposure*" (Synergy, 2012d). The Assessment Report indicated that the RID Pilot System initiative conclusively demonstrated the cost effectiveness of the technology, and therefore the reasonableness of the selected remedy in the Modified ERA that was incorporated and expanded in the Feasibility Study Report in order to effectively treat the contaminated groundwater impacting RID's wells and the successful mitigation of public health exposures to these contaminants at all impacted RID wells.

Pursuant to A.A.C. R18-16-411, RID was to prepare and submit an Operation and Maintenance (O&M) Plan to ADEQ to implement all or any portion of a remedy or early response action. This O&M Plan, which was certified by ADEQ on April 10, 2015, provides equipment and construction details, the sampling and analysis program, and specific O&M and reporting procedures for the RID wellhead treatment systems included in the ADEQ-approved remedial actions, and shall replace all previous editions. Updates and/or revisions will continue to be made to this O&M Plan, as necessary. At a minimum, this O&M Plan will be reviewed on an annual basis to confirm accuracy and completeness.

2.0 BACKGROUND

A summary of the physical setting, hydrogeologic and groundwater conditions, sources of contamination and impacts on RID wells and operations was provided in the WVBA Site Remedial Investigation (RI) Report (Terranext, 2012). The RI Report was published by ADEQ in August 2012, and included a discussion of the nature and extent of contamination in the WVBA Site. Brief descriptions of the Site location and physical characteristics, the contaminants of concern (COCs) present at the Site and the impact of the contamination on the RID water systems are provided in the following sections.

2.1 SITE LOCATION AND PHYSICAL CHARACTERISTICS

Land use within the WVBA is predominantly zoned industrial with smaller tracts of residential (with elementary schools and churches) and commercial. The WVBA Site is located within the City of Phoenix Central City and Estrella urban villages (**Figure 1**). Based on data generated through applied use of the Environmental Justice Screening and Mapping Tool (EJSCREEN) developed by the U.S. Environmental Protection Agency (EPA), there are approximately 51,600 people residing within the general boundaries of the WVBA Site and the demographic profile indicates the residents predominantly comprise a low income, minority population.[1] With the significant acreage of agricultural land available to be developed in the future, the Estrella Village (41 square miles) is identified as a Phoenix targeted growth area, and is expected to experience significant increases in both employment and residential growth (Synergy, 2011b).

Figure 2 depicts the approximate boundaries of the groundwater contamination, as well as relevant features within the WVBA Site. The extent of groundwater contamination associated with the WVBA Site is generally bounded on the north by McDowell Road, on the east by 7th Avenue, on the south by Lower Buckeye Road, and on the west beyond 79th Avenue.

2.2 CONTAMINANTS OF CONCERN

The COCs in the WVBA Site have been identified based on historical and present data obtained from samples collected by ADEQ and RID from the impacted RID groundwater supply wells over the past 20 years. These COCs comprise the commingled WVBA Site plume and are listed as follows (including the chemical name and the Chemical Abstract Service (CAS) number:

- 1,1-Dichloroethene (1,1-DCE) CAS number 75-53-4

[1] *See* www.epa.gov/ejscreen for environmental indicators and demographic data applicable to the general boundaries of the WVBA Site.

- Tetrachloroethene (PCE) CAS number 127-18-4
- Trichloroethene (TCE) CAS number 79-01-6
- 1,1,1-Trichloroethane (TCA) CAS number 71-55-6
- cis 1,2-Dichloroethene (cis 1,2-DCE) CAS number 156-59-2
- 1,1-Dichloroethane (1,1-DCA) CAS number 75-34-3

Chromium is also a COC that occurs locally within the WVBA Site boundaries. The chromium concentrations in the impacted RID wells (Synergy, 2014b) are well below the federal MCL for drinking water and have only been detected in two (2) wells: RID-102 and RID-104; neither of which was selected for wellhead treatment. Consequently, chromium is not included in the sampling and analysis program as part of this O&M Plan.

Only three (3) of the listed COCs (i.e., TCE, PCE and 1,1-DCE) are present in the impacted groundwater within the WVBA Site at concentrations that exceed the MCLs. Consequently, these COCs are referred to as the "target COCs" in this O&M Plan. The target COCs will be used to determine when GAC replacement is necessary.

2.3 WATER QUALITY – TREATMENT SYSTEM WELLS

A summary of recent historical analytical data that presents target COC concentrations for samples collected by ADEQ from RID treatment system wells is included below. All results that are equal to or exceed MCLs are indicated in red text.

Table 1. Summary of Recent Water Quality – Treatment System Wells

All concentrations are presented as micrograms per liter (μg/L):

Sample Date	Well RID-89			Well RID-92			Well RID-95			Well RID-114		
	TCE	PCE	1,1-DCE	TCE	PCE	1,1-DCE	TCE	PCE	1,1-DCE	TCE	PCE	1,1-DCE
Mar-13	34.1	11.0	2.39	73.5	14.7	5.17	54.4	3.44	9.23	48.6	2.20	3.33
Sep-13	37.5	11.7	3.14	86.4	14.5	6.22	59.6	3.71	7.52	39.0	2.63	2.50
Mar-14	35.5	10.3	2.84	76.2	13.5	4.84	44.0	2.99	6.18	45.6	2.86	3.01
Mar-15	33.8	9.39	2.68	81.6	12.3	4.39	42.2	2.80	5.74	48.1	2.51	2.84

2.4 TREATMENT GOALS

The minimum standard for treated water quality at the wellhead treatment systems is the MCL for each of the target COCs, which is consistent with the final Remedial Objectives set forth in the Final RI Report, Appendix AA (Terranext, 2012). The current MCL for each of the target COC's is provided in the following table.

Target COC	MCL (μg/L)
Trichloroethene (TCE)	5.0
Tetrachloroethene (PCE)	5.0
1,1-Dichloroethene (1,1-DCE)	7.0

The point of compliance (POC) sample ports (installed in the 14-inch discharge piping, located downstream of the treatment skids and immediately upstream of the receiver box for each treatment system, see **Figures 3-6**) is the location for demonstrating that each treatment system achieves these Treatment Goals.

3.0 SYSTEM DESCRIPTION

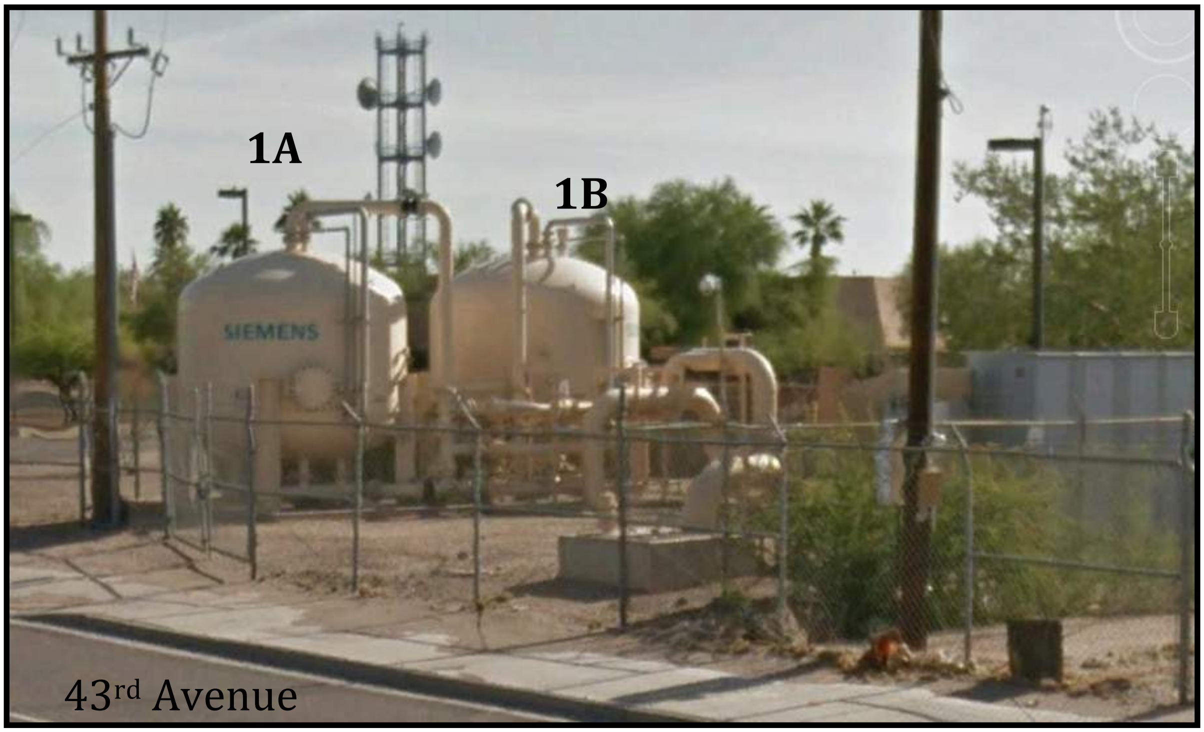
RID has selected a pre-engineered LGAC system, manufactured by Siemens Water Technologies, to treat the discharge from the impacted RID production wells. The selected LGAC systems, described in more detail in Section 4.3, are modular and consist of two (2) GAC pressure vessels, a treatment "skid", with a capacity of 1,000 gallons per minute (gpm, nominal) with Siemens stated maximum of 1,100 gpm. The treatment skids are installed on and anchored to concrete containment pads with 6-inch curbing and sumps. Each discharge structure is enclosed and sealed for volatilization control. Wellhead treatment will be conducted in a manner consistent with the ADEQ-approved remedial actions. Design/record drawings for the previously installed wellhead treatment systems are included as **Appendix A** (RID-89), **Appendix B** (RID-92), **Appendix C** (RID-95), and **Appendix D** (RID-114). Design/record drawings for the additional wellhead treatment systems that will be installed pursuant to ADEQ-approved remedial actions will be included to supplement this O&M Plan.

1. RID-89: Located on the east side of 51st Avenue, approximately ¼-mile north of Buckeye Road; the site area is approximately 4,500 square feet (ft^2). Based on nominal flow rate of 3,400 gpm, RID installed three skids.

   From the north (left) to the south (right), each pair of vessels (skids) are numbered 1, 2, and 3; with individual vessels labeled (again, north to south): 89-1A and 89-1B (skid 1); 89-2A and 89-2B (skid 2); and 89-3A and 89-3B (skid 3).

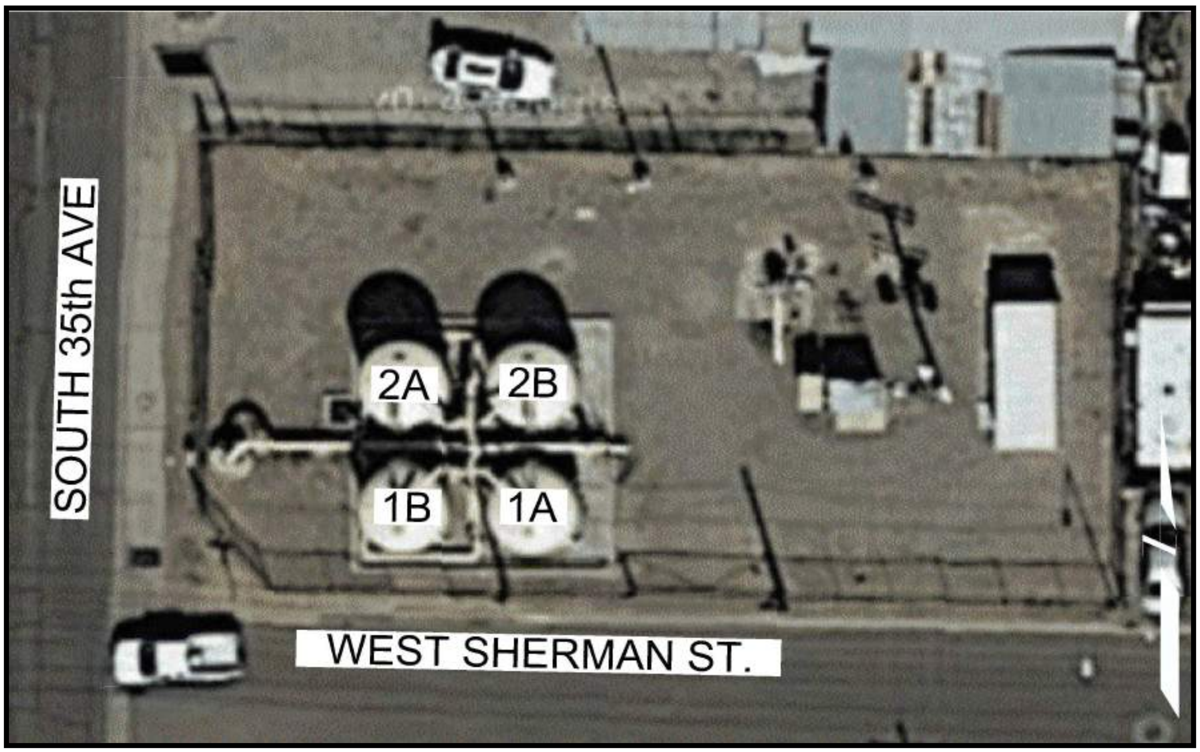
2. RID-92: Located on the east side of 43rde Avenue, approximately ¼-mile north of Buckeye Road; the site area is approximately 2,400 ft^2. Based on nominal flow rate of 1,400 gpm and limited available foot print, RID installed a single skid.

   Vessels are labeled 92-1A (west vessel) and 92-1B.



3. RID-95: Located on the northeast corner of Sherman Street and 35th Avenue, approximately ¼-mile north of Buckeye Road; the site area is approximately 6,900 ft^2. Based on nominal flow rate of 1,850 gpm, RID installed two skids.

   From south to north, skids are numbered 1 and 2; with vessels labeled: 95-1A (east vessel) and 95-1B for skid 1; and 95-2A (west vessel) and 95-2B for skid 2.



4. RID-114: Located at the southwest corner of 23rd Avenue and Van Buren Street; the site area is approximately 7,000 ft^2. Based on nominal flow rate of 2,500 gpm, RID installed three skids.

   From north to south, skids are numbered 1, 2, and 3; with vessels labeled: 114-1B and 114-1A (skid 1); 114-2B and 114-2A (skid 2); 114-3B and 114-3A (skid 3).

4.0 OPERATION AND MAINTENANCE

The following sections describe the specific details for operating and maintaining the wellhead treatment systems, including a notifications procedure during system operation upset events; and details for RID's well pumps, the selected LGAC treatment skids, wellhead treatment system operations, instrumentation and controls, and the sampling and analysis program.

4.1 SYSTEM OPERATION UPSET EVENT NOTFICATIONS

The Operator receives automated notifications (on his mobile phone) to alert in the event of certain control conditions described in detail in Section 4.5.9, and is required to respond, as appropriate, to each notification within 2 hours. The Operator will notify RID and Synergy in the event of significant process control change(s), problem(s) or failure(s). As soon as the issue(s) of the event are reviewed and fully understood, Synergy will notify ADEQ by telephone within 24 hours of operational changes made to the wellhead treatment systems, if the quality of the treated water could be affected, or if releases to the environment have occurred.

Contact information for the individuals to be notified by Operator/Synergy is included below:

Roosevelt Irrigation District

Donovan Neese, PE
Superintendent
Email: dneese@rooseveltirrigation.org
Phone: (623) 670-4760

Ken Craig
Water Operations Manager
Email: kcraig@rooseveltirrigation.org
Phone: (623) 695-5855
On-Duty Water Master: (623) 386-2046

Agency Oversight

Scott Green
Arizona Department of Environmental Quality
Email: Green.Scott@azdeq.gov
Phone: (602) 771-1612

In accordance with A.A.C. R18-16-411(E)(4), this O&M Plan shall include "a process for the treatment system Operator to promptly notify potentially affected water providers of a failure of a key treatment system component that could affect the quality of a discharge of treated water."

Treated water from the wellhead treatment systems currently is exclusively discharged to RID canals and laterals for agricultural use. Consequently, there are no other potentially affected water providers within the WVBA Site that would be affected by a discharge of treated water in the event of significant process control issues or failures at any of the wellhead treatment systems. However, at such time in the future when RID plans to serve treated water to persons or parties for municipal and industrial end use, this O&M Plan will be revised to identify the affected water provider(s) and the process by which RID will promptly notify those water providers of any failure of a key treatment system component that could affect the quality of the discharge of treated water. The revised O&M Plan will be submitted for ADEQ approval at least 90 days prior to initiation of water delivery to the affected water provider(s).

4.2 WELL AND TREATMENT SYSTEM DETAILS

Table 2 provides details for well construction (i.e., hole depth, screen intervals, units screened, casing total depth and casing diameters), historical depth to water and pumping water levels, and pumps/motors currently installed and operating at each wellhead treatment system site. The control strategy for each well pump is provided in Section 4.5.1. Following is a summary of normal operating values for each of the currently installed wellhead treatment systems. A similar description of the operating parameters for the additional wellhead treatment systems that will be installed pursuant to ADEQ-approved remedial actions will be included to supplement this O&M Plan.

RID-89

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	0.5 psi
Wellhead Pressure (Treatment)	16.5 psi
Flow Rate (Bypass)	3,200-3,300 gpm
Flow Rate (Treatment)	2,300-2,600 gpm
Skid 1 Post-Lead Vessel Pressure	12 psi
Skid 1 Effluent Pressure	2.0 psi
Skid 2 Post-Lead Vessel Pressure	12 psi
Skid 2 Effluent Pressure	2.0 psi
Skid 3 Post-Lead Vessel Pressure	11 psi
Skid 3 Effluent Pressure	1.5 psi

<u>Notes:</u>
psi = pounds per square inch
gpm = gallons per minute

RID-92

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	0.5 psi
Wellhead Pressure (Treatment)	21 psi
Flow Rate (Bypass)	1,400 gpm
Flow Rate (Treatment)	1,100-1,200 gpm
Skid 1 Post-Lead Vessel Pressure	2.0 psi
Skid 1 Effluent Pressure	1.0 psi

RID-95

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	1.0 psi
Wellhead Pressure (Treatment)	12.5 psi
Flow Rate (Bypass)	1,750 gpm
Flow Rate (Treatment)	1,500-1,600 gpm
Skid 1 Post-Lead Vessel Pressure	5.0 psi
Skid 1 Effluent Pressure	2.0 psi
Skid 2 Post-Lead Vessel Pressure	7.0 psi
Skid 2 Effluent Pressure	2.0 psi

RID-114

Parameter	Normal Operating Value
Wellhead Pressure (Bypass)	0.5 psi
Wellhead Pressure (Treatment)	11.5 psi
Flow Rate (Bypass)	2,400 gpm
Flow Rate (Treatment)	2,100-2,300 gpm
Skid 1 Post-Lead Vessel Pressure	7.0 psi
Skid 1 Effluent Pressure	2.0 psi
Skid 2 Post-Lead Vessel Pressure	7.0 psi
Skid 2 Effluent Pressure	3.0 psi
Skid 3 Post-Lead Vessel Pressure	6.0 psi
Skid 3 Effluent Pressure	2.5 psi

4.3 LGAC TREATMENT SKIDS

The wellhead treatment systems consist of Siemens HP-1220 LGAC treatment skids, each capable of treating a nominal flow of 1,100 gpm of water in series (lead-lag) configuration. The numbers of skids at each well site currently include: RID-89 (3), RID-92 (1), RID-95 (2) and RID-114 (3), for a total of 9 skids.

The LGAC treatment skids include the following standard design features:

- Down-flow configuration to facilitate backwash;
- Integrated piping (8-inch schedule 40 carbon steel) with cast iron gear/wheel butterfly valves with EPDM seats, configured to allow series, parallel or vessel-isolation flow;
- Systems operate utilizing existing well equipment to pump the impacted groundwater through the LGAC vessels for treatment and periodic backwash;
- Equipped with sample ports at the skid influent, 25%, 50% and 75% of GAC bed depth, and vessel effluent to enable monitoring of mass transfer zone and breakthrough;
- 20,000 pound carbon capacity in each carbon steel vessel (7,520 gallon volume);
- Operating flow rate of 1,100/2,200 gpm (series/parallel) per skid and 1,000 gpm backwash flow rate (higher flow rates can be achieved but empty bed contact time would decrease proportionally);
- Integrated GAC transfer piping (4-inch Schedule 10 304L stainless steel); and,
- Vessels and piping are rated to 125 psi and burst discs are integral to the piping to safely release and divert water in the event of over-pressure.

During 2013 and 2014, critical maintenance work was needed at all four (4) current wellhead treatment systems (i.e., all 18 vessels) to replace corroded piping (4-inch, Schedule 10 304L stainless steel GAC fill and removal lines), which were covered under warranty. Similar defects have been observed on the Siemens GAC equipment installed at the North Indian Bend Wash federal Superfund Site. Each pipe was removed and replaced by Siemens' (now Evoqua Water Technologies) contractor Smyth Industries, of Tucson, Arizona with the GAC fill lines primarily replaced in 2013 and the GAC removal lines replaced on 10 of 18 vessels during carbon change-out activities from June through October 2014. The remaining GAC removal lines will be replaced when carbon change-out activities are needed on the 8 currently remaining vessels.

4.4 SYSTEM OPERATION

General system operation for each LGAC skid includes operation in treatment mode, bypass mode, and a modified treatment mode to facilitate LGAC change-outs and/or backwash. Each skid is configured for series (or lead-lag) operation for normal treatment mode, but are capable of parallel or single vessel operation, as necessary, to facilitate maintenance activities.

Operational performance data will be continuously monitored and collected on a monthly basis using the instrumentation and supervisory control and data acquisition (SCADA) system described in Section 4.5.6.

An Operation & Maintenance Manual (prepared by Siemens) for the pre-engineered LGAC skids is included as **Appendix E**, and provides equipment details/specifications including: standard procedures to operate the treatment skids (i.e., start-up, carbon changes, backwashing), troubleshooting, system monitoring, shutdown and emergency procedures, maintenance, lists of scheduled materials (with part numbers) on the drawings in Section 8.0, and specifications for the vessels (i.e., drain system, valves, burst disks, spray nozzles, pressure gauges, and interior/exterior coatings). Although the Operation & Maintenance Manual specifically identifies "Well Site 95", the same Manual is applicable to the equipment and operations for the other three (3) current wellhead treatment systems (RID-89, RID-92 and RID-114). Therefore, only one Manual is included as part of this O&M Plan.

A flow diagram and valve sequence chart are also included in the Siemens Operation & Maintenance Manual and on **Figures 3-6**. Each valve associated with the HP-1220 systems has been clearly labeled in the field to help the Operator when making changes to the operation of the treatment systems.

4.4.1 Treatment Mode

Each LGAC skid is operated in conjunction with RID's pumping schedule with cessation of treatment during well maintenance activities, treatment system maintenance activities (requiring system shut-down), lack of adequate funds from third parties or cost recovery actions or unanticipated failures (including but not limited to: power outages, critical alarms, or equipment malfunctions).

4.4.2 Bypass Mode

Should it become necessary to shut off any of the treatment trains, and RID requires the flow from that well, the untreated flow may be temporarily bypassed (in part or in whole) around the treatment system and discharged directly into the existing receiver box until treatment can resume (utilizing the 3-way valve, see Section 4.5.4).

The notification procedure in Section 4.1 shall be followed if a treatment system is changed from treatment mode to bypass mode (full bypass) due to a system upset event. Other operational changes that require partial bypass, including carbon change-out activities or

changes in RID's water demand that require full bypass, for example, will be documented in the Monthly Progress Reports (Section 6.2).
There is a routine occurrence when operation in partial bypass mode is necessary at the RID-92 wellhead treatment system. Since there is only one treatment skid at RID-92, partial bypass is necessary during carbon change out activities to fluidize the GAC for removal and refilling activities, and backwashing. Partial bypass is necessary in this case to prevent excessively high flow rate during backwash, which could result in possible loss of GAC. Since all other treatment systems utilize two or three treatment skids, this mode of routine partial bypass is only necessary at the RID-92 wellhead treatment system.

During full or partial bypass operation, the SCADA system is still functioning and the change in flow path is shown on the control screens and captured by data acquisition. When this occurs, the wellhead pressure will decrease and flows will increase (due to reduced pressure head). During full bypass mode operation, pressure differential across the lead and lag vessels goes to zero, and therefore, no alarms are triggered.

4.4.3 LGAC Change-Outs and Backwash

LGAC bed life will be assessed/monitored in each treatment system by sampling and analysis for target COCs as described in Section 4.6. Carbon change-outs will be scheduled based on COC concentrations as determined in weekly water quality analytical results. Trigger levels have been established based on the breakthrough performance from the last several years of treatment system operation at each of the four (4) current treatment systems, as described below.

Each of the four treatment systems has a unique breakthrough profile that is dependant on the mixture and relative concentrations of the COC's as well as the flow rate through each system. Breakthrough curves at RID-89 and RID-114 treatment systems are very similar, however, due to the fact that both have relatively low concentrations of 1,1-DCE in the pumped groundwater (less than 3 μg/L). Breakthrough curves are also similar for treatment systems at RID-92 and RID-95 where pumped groundwater contains higher concentrations of 1,1-DCE, between 6 and 8 μg/L.

The MCL (and treatment goal) for 1,1-DCE is 7 μg/L; therefore, exceedance of this treatment goal at RID-89 or RID-114 is extremely unlikely with such low influent concentrations. There is the potential, however, for exceedance of this treatment goal at RID-92 and RID-95. Therefore, two sets of trigger levels have been established.

Trigger levels for managing GAC replacements include both "alert" levels and "action" levels. Alert levels are in place to prompt a heightened awareness and review of the water quality data trends to ensure that no significant changes have occurred (e.g. abrupt rise in influent concentration) and to provide advanced consideration in change-out planning. Action levels are in place to trigger mandatory initiation of GAC change-out.

These trigger levels apply to the COC concentrations noted in the water quality analytical results for the samples specified as follows:

<u>RID-89 and RID-114</u>

Alert Level:	**3.0** μg/L	1,1-DCE	Influent Sample
	4.0 μg/L	1,1-DCE	Point of Compliance
Action Level:	**2.5** μg/L	TCE or PCE	Point of Compliance **(1/2 MCL)**
	6.5 μg/L	1,1-DCE	Point of Compliance

<u>RID-92 and RID-95</u>

Alert Level:	**1.5** μg/L	TCE or PCE	Point of Compliance
	2.5 μg/L	1,1-DCE	Point of Compliance
Action Level:	**2.5** μg/L	TCE or PCE	Point of Compliance **(1/2 MCL)**
	3.5 μg/L	1,1-DCE	Point of Compliance **(1/2 MCL)**

Again, “alert levels” are established as an early warning indicator whereas “action levels” trigger mandatory initiation of GAC change-out. GAC may be replaced prior to exceeding an action level, however, at the discretion of the operator for reasons such as to facilitate scheduled or unscheduled maintenance or in preparation for an extended shutdown (particularly with those beds near exhaustion).

A carbon change-out with reactivated GAC will be scheduled according to the conditions prescribed. When such a condition is observed, the lead vessel of the skid with the highest target COC concentration in the Mid-Skid sample will be scheduled for the change-out unless the change-out is initiated to facilitate maintenance on a different vessel[2].

During each carbon change-out, the lag vessel will be reconfigured as lead and the spent GAC removed from the exhausted vessel and replaced with fresh reactivated GAC. During removal and replacement of the spent GAC from the exhausted vessel, the remaining vessel will continue to treat the flow on a stand-alone basis (i.e., single pass). In some instances, it may be

[2] Currently, the RID-92 wellhead treatment system only has a single skid.

necessary to isolate an entire skid and/or switch to partial or full bypass to facilitate maintenance activities.

Following recharging of the exhausted vessel, the recharged vessel will be backwashed to remove fines, left to soak for approximately 24 hours to remove entrained air, and put back into service as the lag vessel and remain in that configuration until the lead vessel requires a carbon change-out. Backwash will be conducted at a flow of approximately 1,000 gpm (using treated water conveyed from the new lead vessel while operating in stand-alone basis) and backwash water will be diverted from the backwashed vessel directly to the discharge receiver box.

Based on carbon change-out frequencies for each of the current wellhead treatment systems[3] to date, the estimated change-out schedule per vessel at each site is included below:

- RID-89: 4-5 months of operation
- RID-92: 2-3 months of operation
- RID-95: 2-3 months of operation
- RID-114: 5-6 months of operation

4.5 INSTRUMENTATION AND CONTROLS

The wellhead treatment systems are equipped with instrumentation and controls (I&C), designed and integrated by Vertech, that provide real-time monitoring of key performance parameters of system operation. The I&C also enables remote operation and monitoring of system operations and provides alarm notification for key process and control parameters. Control System record drawings for the current wellhead treatment systems are included in **Appendix A** (RID-89), **Appendix B** (RID-92), **Appendix C** (RID-95), and **Appendix D** (RID-114).

Instrumentation is included to monitor:

- Well pump run status;
- Well discharge and bypass flow rates (instantaneous and totalized);
- Flow to each treatment skid (instantaneous and totalized);
- Wellhead pressure; and,
- Differential pressure across each treatment skid.

Controls/alarms are included for:

- Pump start/stop;

[3] These systems currently only operate 7-8 months per year based on RID's historical operations.

- Bypass flow;
- Low flow at each treatment skid; and,
- Water level in sumps and sump pump start/stop.

These I&C nodes are integrated into a SCADA system that allows for remote control of the systems as well as continuous monitoring capabilities and data storage to document key aspects of treatment system operations and demonstrate the level of reliability required to ensure the successful remediation of the groundwater supply (i.e., to achieve Treatment Goals) and the protection of public health.

The following sections describe the various I&C components, including O&M requirements for each. Equipment manuals for each component are included in **Appendix F**.

4.5.1 Well Pumps

The well pumps for the wellhead treatment systems convey groundwater through the treatment skids (treatment mode) or directly to the discharge structure (bypass mode). The pumps can be controlled manually from the local Operator Interface Terminal (OIT), mounted to the front of the Remote Terminal Unit (RTU) control panel, or operated remotely from the OIT in the control room at RID-95 (or via remote connection to the OIT in the control room). The OIT in the control room can control operations for all four (4) current wellhead treatment systems.

System Start-Up and Shut Down Procedures

Prior to start-up of each wellhead treatment system, the Operator shall inspect the system components for potential problems (including water accumulation in the containment area sump[s]), inspect piping for signs of leaks, verify all control and isolation valves are positioned properly, and acknowledge/clear any alarms on the OITs. The Operator will check to see if the pump switch at each site is in “Auto” mode inside the motor control center (MCC) cabinet.

- Well pumps are started manually by pressing the “Main Pump Start” push button on the local OIT or the OIT located in the control room (or via remote connection to the OIT in the control room).
- Following start-up, the Operator will monitor the treatment systems for a minimum of 15 minutes to verify proper operation.
- Each well pump will run continuously until manually stopped by pressing the “Main Pump Stop” push button on the local OIT or at the OIT located in the control room (or via remote connection to the OIT in the control room). Well pumps can also be

manually stopped by switching from Auto to OFF using the local controls in the switchgear cabinet adjacent to the well.

Shut Down Conditions

- Each well pump will stop automatically in the event of a motor overload condition. The pump will need to be restarted manually at the MCC cabinet after the overload relay for the pump motor starter is reset.
- In the event of a power failure/outage while the pump is running (see Section 4.5.9), the pump will attempt to restart one time. If the attempt fails, the pump will need to be restarted manually at the local OIT or remotely at the control room after the SCADA computer is restarted.
- In the event of an overload condition with the pump motor starter, an alarm will be displayed on the OIT at the local control panel and at the OIT in the control room, and the Operator will be notified.
- In the event of a low-low flow rate critical alarm at a treatment skid, the Operator will be notified and the well pump will automatically shut off at that site. For this critical alarm, the Operator will follow the system upset notifications procedure described in Section 4.1.
- When water (e.g., rain water or process water) accumulates in a sump, a high-level switch alarm will result when water reaches the first float alarm point. The Operator will be notified and the sump pump(s) will start automatically to discharge the water until the water level drops to below the first float alarm point. If the accumulation of water reaches the second float alarm point, a high-high critical alarm will result in another notification to the Operator, and the well pump will automatically shut off. For this critical alarm, the Operator will follow the system upset notifications procedure described in Section 4.1.

4.5.2 Flow Meters

Manufacturer/Model	Size	Sensor/Transmitter Type
Siemens, Sitrans F M Magflo®	8”& 14”	MAG 5100W/MAG 5000

- 8-inch flow meters installed one per treatment skid to measure instantaneous and totalized flow of raw groundwater (i.e., influent).
- 14-inch flow meters installed one per well site on the bypass piping. At RID-89, RID-92 and RID-114, the flow meter measures well discharge flow in both treatment and bypass modes (instantaneous and totalized values). At RID-95, the 14-inch flow meter only measures bypass flow (instantaneous and totalized) due to operational/mechanical

constraints within the treatment system concrete pad. Treatment flow at RID-95 is measured by the two 8-inch flow meters, which are combined to derive the total well discharge flow rate.

- If a treatment skid flow rate at a site falls below the low-low flow rate critical alarm value, (summarized in Section 4.5.6), the Operator will be notified and the well pump at that site will automatically shut off.

4.5.3 Pressure Transmitters

Manufacturer/Model	Range	Order No.
Siemens, Sitrans P200	0-200 psig	7MF1565-4CB

- At each site, one pressure transmitter is located upstream of the 3-way valve to monitor wellhead pressure (see **Figures 3-6**).
- At each site, one pressure transmitter is located on the effluent piping of each treatment skid to monitor effluent water pressure and differential pressure across the vessels (see **Figures 3-6**). If the differential pressure (calculated from the values measured at the transmitter located immediately downstream of the wellhead and the transmitter at the effluent piping of each treatment skid) increases to the high differential pressure value of 25 psi (which could indicate solid deposits accumulating in the carbon bed, for example), an alarm will be displayed on the OIT and the Operator will be notified. This is not a critical alarm, and therefore, will not automatically shut off the well pump.

4.5.4 3-Way Valves

Manufacturer/Model	# of Positions	Power
VSI, Series 1000 Electric Actuator [1200]	2 (on/off)	AC 120V/240V AC24

- Each wellhead treatment system includes one (1) 3-way valve that can be controlled manually at the valve (using an Allen handle at the manual override location), or using the electric actuator through the local OIT mounted to the front of the RTU control panel at each site, or remotely from the OIT in the central control room (or via remote connection to the OIT in the control room). In normal operation, the valve will be closed on the bypass piping and open on the influent piping to each treatment skid.
- To prevent water hammer, power-assisted closing/opening of valve is paced to occur over a 120-second period (i.e., over 2X safety factor based on the manufacturer's specifications) when changing from normal operation to bypass mode, or from bypass mode to normal operation.

- For temporary changes in flow between treatment and bypass, the Operator may manually open/close the bypass valve until the desired flow rates are obtained (using an Allen handle at the manual override location). The manual opening/closing of the bypass valve is conducted at a controlled rate to prevent water hammer.

4.5.5 Sumps and Level Switches

Manufacturer/Model	# of Floats	Order No. / Switch Type
Dwyer, Mercoid Series FSW2 Free-Floating Level Switch	2 (high/high-high)	FSW2-ONPN-20 / SPST NO FSW2-CNPN-20 / SPST NC

- The concrete pads at each site are constructed with approximate 6-inch berms along the pad perimeter to contain and prevent release of water and the pads slope slightly towards the collection sump(s) to facilitate collection and detection of any incidental rainfall or system leakage.
- The wellhead treatment systems at RID-92 and RID-95 each have one sump equipped with two (2) level sensors/switches.
- The RID-89 and RID-114 wellhead treatment systems each have two sumps, both equipped with two (2) level sensors/switches that operate independently.
- Each sump is covered by a grate conforming to Maricopa Association of Governments (MAG) detail 539.
- The Operator will inspect each sump on a weekly basis for the accumulation of water and if present, will determine the source.
- When water (e.g., rain water or process water from sampling or maintenance activities) accumulates in a sump, a high-level switch alarm will result when water reaches the first float alarm point. The Operator will be notified and the sump pump(s) will start automatically to discharge the water until the water level drops to below the first float alarm point. If the accumulation of water reaches the second float alarm point, a high-high critical alarm will result in another notification to the Operator, and the well pump will automatically shut off. For this critical alarm, the Operator will follow the system upset notifications procedure described in Section 4.1.
- The water contained in the sump will be discharged via 1 ½" to 2" galvanized steel piping by a ¾ horsepower pump (rated for 50 gpm) to the discharge structure/receiver box at the well site.

4.5.6 SCADA System

Each wellhead treatment system site is equipped with a wireless transceiver that allows communication with the control room at RID-95, which serves as the central hub for the SCADA system. Screen shots of the SCADA system are included in **Appendix G**. A summary of the

SCADA system alarm conditions is included below. The low-low flow rate critical alarm value for each skid is calculated as 75% of the flow rate from the well divided by the number of treatment skids for that site. The Operator will be notified for each alarm condition. Other critical and non-critical conditions are as described in previous sections.

Condition	Alarm Value
RID-89 Low-Low Flow Rate - 3 Treatment Skids (Critical)	75% of the well flow rate divided by the number of treatment skids
RID-92 Low-Low Flow Rate - 1 Treatment Skid (Critical)	
RID-95 Low-Low Flow Rate - 2 Treatment Skids (Critical)	
RID-114 Low-Low Flow Rate - 3 Treatment Skids (Critical)	
Treatment Skid Differential Pressure (Non-Critical)	25 psi
High Level in Sump (Non-Critical)	First float
High-High Level in Sump (Critical)	Second float
High Temperature (Non-Critical)	120°F

4.5.7 Temperature Sensors

Manufacturer/Model	Product No.
Siemens, 4-20 mA Room Temperature Sensor	536-753 (20 to 120°F)

- Temperature sensors are installed at all the wellhead treatment systems.
- The sensors monitor the cabinet temperature containing the control hardware and the temperature inside of the RID-95 control room. If the alarm value 120 degrees Fahrenheit (°F) is exceeded, the Operator will be notified, but no change in the operational status of the system will occur.

4.5.8 Site Security

Site security at each wellhead treatment system site includes:

- New lighting fixtures that comply with local night sky ordinance.
- New wrought-iron fencing and access gates set-up with electronic sensing alarms (except at RID-92).

- Keys for the locks at each well site access gate will be provided to approved/authorized personnel only (Note: some locks are daisy-chained to allow access by Salt River Project personnel to read the electrical meters).
- Secure access to electrical equipment.
- Cameras for 24-hour site surveillance. Cameras can be remotely operated (including pan/zoom capability) on the SCADA computer to assist the Operator in rapid assessment of system conditions.

4.5.9 System Operation Upset Events

An unscheduled shutdown of the wellhead treatment systems may occur due to various reasons, which include (but are not limited to) the following:

- Power Outage – power supply outages may occur as a result of lightning storms, downed power lines, down transformer, etc. If any of the treatment systems have a loss of power, the system will automatically restart the well pump one time, in bypass mode. In the event of a power outage, a back-up power supply will allow for the SCADA system to remain operational, and the Operator will be notified of the alarm. The Operator will need to physically visit the treatment system to inspect the cause of the alarm, coordinate restoration of power supply at the site, and restart the treatment system.

- Heavy Rain – as indicated in Section 4.5.5, each sump is equipped with a two-level sensor/switch. In the event that a heavy rainstorm causes accumulation of rain water in a sump to reach the second float (triggering a high-high critical alarm), the Operator will be notified and the well pump will automatically shut off.

- Critical Alarms – there are a number of alarm conditions (summarized in Section 4.5.6), that when triggered, will result in an automatic notification to the Operator. However, two types of critical alarms (i.e., low-low flow rate for each treatment skid and a high-high level in a sump), will automatically shut off the well pump.

Please refer to Section 4.1 for notification procedures for wellhead treatment system upset events.

4.6 SAMPLING AND ANALYSIS

This section provides the methods and procedures to collect and analyze wellhead treatment system samples.

4.6.1 Purpose of Sampling and Analysis Program

The goal of the sampling and analysis program is to collect data to:

- Determine compliance with the water quality Treatment Goals for the target COCs;
- Determine when LGAC bed breakthrough/exhaustion occurs and LGAC change-out is needed; and,
- Determine the approximate mass of target COCs being removed at each wellhead treatment system.

4.6.2 Frequency and Locations of Sampling

The proposed data collection/sampling programs are presented in the matrix below. The location and frequency of each sample will be conducted for each of the individual LGAC treatment skids. Sampling frequency and locations refer only to the "lead" vessel except where noted.

Wellhead Treatment System Sampling Program Matrix

LOCATION	FREQUENCY
Influent Sample Port @ Wellhead	Weekly
	Monthly*
Mid-Skid Sample Port	Weekly
	Monthly*
Point of Compliance (POC)	Weekly

The asterisk next to each "Monthly" indicates that a change to this frequency will be based on an evaluation of "Weekly" data and may be changed after the treatment system reaches steady-state (if agreed to in advance by ADEQ). Sampling will revert to "Weekly" should significant variation or unanticipated results be observed.

The POC sample ports (installed at the 14-inch discharge piping, located downstream of the treatment skids and immediately upstream of each receiver box, see **Figures 3-6**) will be the location for demonstrating that the treatment system achieves the Treatment Goals for the target COCs described in Section 2.4. Field quality control (QC) samples will be collected as described in Section 4.6.4.

4.6.3 Sampling Methods

The following section provides details regarding the methods that will be used for the wellhead treatment system sampling program. Sampling will be conducted consistent with the provisions of the Health and Safety Plan, included as **Appendix H**.

Sampling Equipment & Procedure

Prior to sample collection, each sampling port will be purged for approximately 15-30 seconds to remove any stagnant water (i.e., non-representative water). Purge water from the influent and effluent sample ports will be collected in a two (2) gallon bucket, and will be disposed within the treatment system concrete containment structure.

Each water quality sample will be collected in a set of two (2) 40-milliliter volatile organic analysis (VOA) vials preserved with 1:1 hydrochloric acid (HCl). Samples will be collected with zero headspace. Each VOA vial will be tilted to approximately 45 degrees of vertical, and filled using a low flow rate (i.e., approximately 250 milliliters per minute of sample). The vial will be filled to the brim and then, using the cap, a small amount of water shall be added until a convex meniscus is formed. The vial will then be capped, turned upside down, and tapped to verify no headspace. Samples will be stored in a cooler with wet ice at 4° Celsius (C), ± 2°C, and hand delivered to the analytical laboratory.

4.6.4 Analytical Methods and Procedures

Samples will be analyzed following protocols that include quality control (QC) provisions and sample documentation and management practices as described in the following sections.

Sample Analyses

Water samples will be analyzed for VOCs following EPA Method 8260B and submitted to Airtech Environmental Laboratories (AEL) of Phoenix, Arizona. AEL is an environmental testing laboratory certified by ADHS under license number AZ0740. AEL will analyze for the six (6) WVBA Site COCs. The reporting limit for each COC will be 0.5 micrograms per liter.

Data quality control practices will be in accordance with the AEL standard operating procedure (SOP) for analysis of VOCs by EPA Method 8260B (**Appendix I**). Standard quality control requires analysis of a Laboratory Control Sample (LCS), LCS duplicate, internal standard, and surrogate analytes with each sample set. The 8260B method requires analytical accuracy to fall within a series of ranges of percent recoveries for internal standards and surrogates (see **Appendix I**). Laboratory duplicates must be less than or equal to 20 relative percent difference (RPD). Data quality control outside of these limits will be re-run if possible, or appropriately flagged with the reported results.

<u>Quality Control</u>

Quality control measures will be employed to evaluate both the field sampling procedures and techniques as well as the laboratory procedures and performance of instrumentation.

Field QC samples (including trip blanks and field duplicates) will be collected to help evaluate conditions resulting from field conditions and activities. Field QC samples may be used to evaluate variability in environmental sampling and analysis of organic contaminants.

Field duplicate samples will be collected and treated independently of its counterpart in order to assess field sampling procedures and laboratory precision and accuracy, through comparison of the results, and collected at a frequency of one (1) per sampling event. Duplicate samples will be preserved, packaged, and sealed in the same manner as the primary samples. A separate sample number and identification will be assigned to the duplicate, and it will be submitted blind to the laboratory. Identity of the duplicate sample will be recorded on the Weekly Operation and Maintenance Inspection Form (**Appendix J**).

Trip blank samples are used to determine if VOC water samples have been contaminated during transport from the field to the lab. The trip blanks are prepared by the laboratory by filling a VOA vial head-space free with organic free water, preserved with 1:1 HCl, labeled as “Trip Blank” or “TB” with the preparation date included on the custody seal. Trip blanks will be included in each cooler used to transport water samples to the laboratory. The results of the trip blanks are a key aspect of the overall QC system for the sampling program, and will be included in the analytical results report.

Laboratory quality control samples are certified standards analyzed by the laboratory (including matrix spike samples and duplicates) to demonstrate accuracy on a daily basis. Since samples to be used as matrix spikes are randomly selected by the laboratory analyst after receipt of samples, it is understood that such analyses may or may not include samples from any given sampling event or location.

Laboratory procedures will be evaluated using field duplicate samples, matrix spikes and other internal procedures defined by the analytical method and analytical laboratory.

Sample Documentation and Management

Chain-of-custody records are completed for each sampling event. The chain-of-custody record will be completed as samples are collected. An example chain-of-custody record for AEL is provided as **Appendix K** and will accompany the samples to the laboratory. Information to be entered on each chain-of-custody record includes:

- Project name
- Project manager/contact person
- Printed name of sampler and signature
- Date and time of collection
- Sample matrix identification
- Number of containers collected for each sample
- Sample identification
- Analyses requested
- Turn-around-time requested
- Dates of possession
- Name and signature of person relinquishing samples
- Date of sample receipt
- Time of sample receipt
- Name and signature of person receiving the samples
- Remarks pertinent to sample collection, preparation, preservation, and analyses

Samples will be submitted as soon as possible (i.e., on the date of sampling) to AEL with requested turnaround time of five (5) days and VOC analyses following EPA Method 8260B, which has a hold time of 14 days.

All documentation will be made in indelible ink. Corrections will be made by drawing a line through the error and entering the correct information. Both the error and the correct information must be legible. The person making the correction will initial the document where changes are made.

5.0 SPENT GAC MANAGEMENT

For each wellhead treatment system site, spent GAC must currently be profiled every two years by the carbon vendor. Synergy will coordinate the profiling process, contacting the carbon vendor a minimum of six weeks prior to an anticipated carbon change-out so that a grab sample of spent GAC can be collected and analyzed. The grab sample shall be collected by the carbon vendor using a 16-ounce glass jar (or similar) by accessing the 14-inch by 18-inch elliptical man-way located at the top of each vessel (see Section 8.0 of the Siemens O&M Manual in **Appendix E**). Following satisfactory completion of the profiling process, spent GAC can be removed and transported off-site to a reactivation facility provided the profile indicates the GAC as non-hazardous. All historical profiles have indicated spent GAC from the wellhead treatment systems were non-hazardous. All profile records will be maintained in the Field Office at RID-95.

6.0 DOCUMENTATION AND REPORTING

This section includes the ongoing, periodic documentation and reporting necessary for effective monitoring of the wellhead treatment systems.

6.1 WEEKLY INSPECTION FORMS

Inspections will be conducted once per week to monitor the operational and physical conditions at each wellhead treatment system. A blank inspection form is included as **Appendix J**, and provides for collecting data related to water flow rates; operating pressures at the wellhead and across the treatment vessels, alarms, and equipment inspections and maintenance/repairs. The Operator will complete the form during each inspection. All inspection data and information will then be uploaded to the operations database for the wellhead treatment systems. The inspection form will be reviewed annually (at a minimum) and updated as appropriate.

6.2 MONTHLY PROGRESS REPORTING

For each month that the wellhead treatment systems are in operation, a Monthly Progress Report will be prepared to document remedy progress. RID will provide ADEQ's Remedial Projects Unit with one (1) hardcopy and one (1) electronic copy of each Report by the 15th of the month that follows the reporting period. An example of a typical Monthly Progress Report (excluding copies of the final laboratory reports) is provided as **Appendix L**. Each Monthly Progress Report will include the following, at a minimum:

- Approximate mass of target COCs removed and groundwater volume treated during the reporting period, and cumulative total of target COCs removed and groundwater volume treated since system start-up for each treatment system and total for all sites;
- Tabular summary of wellhead treatment system samples collected and analytical results for the reporting period;
- Copies of final laboratory reports for the reporting period;
- Operational hours/percentage for each wellhead treatment system during the reporting period;
- Dates of carbon change-outs conducted during the reporting period;
- Summary of any malfunctions which caused the wellhead treatment systems to be offline during the reporting period;

- Summary of the maintenance activities performed to correct those malfunctions during the reporting period;
- Summary of system operation upset events (see Section 4.1) reported to ADEQ during the reporting period; and,
- Copies of the weekly inspection forms during the reporting period.

The most recent Monthly Progress Reports (without voluminous analytical laboratory results) are available on the West Valley Groundwater Cleanup Coalition website (http://www.wvgroundwater.org), under the "Project Documents" tab.

7.0 KEY CONTACTS LIST

Key contacts for the wellhead treatment systems include:

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