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& ASSOCIATES
Water Resource Consultants

Implementation Plan

September 25, 2009

Prepared for:
Gallagher & Kennedy, P.A.

Roosevelt Irrigation District Groundwater Response Action

West Van Buren Water Quality Assurance Revolving Fund Site

DRAFT

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& ASSOCIATES

September 25, 2009
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ROOSEVELT IRRIGATION DISTRICT
GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN WATER QUALITY ASSURANCE REVOLVING FUND SITE

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ROOSEVELT IRRIGATION DISTRICT
GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN WATER QUALITY ASSURANCE REVOLVING FUND SITE

EXECUTIVE SUMMARY

This document presents a preliminary evaluation of and conceptual implementation plan for a groundwater response action to address extensive groundwater contamination in the West Van Buren Area (WVBA) Water Quality Assurance Revolving Fund (WQARF) Site (the WVBA Site) that currently impacts or threatens to impact Roosevelt Irrigation District (RID) wells, its operations, and the unrestricted use of its water supply **(Figure ES-1)**. In accordance with Arizona statute and rule[1], a reasonable, economical, and technically feasible groundwater response action is required to prevent further groundwater contamination; protect public health, welfare and the environment; eliminate public exposure pathways to contaminated groundwater; and restore groundwater quality to acceptable levels that meet all reasonably foreseeable beneficial uses for all water users and providers.

RID, the largest water provider in the WVBA Site, currently operates 31 large capacity groundwater production wells and a water conveyance system within the WVBA Site **(Figure ES-1)**. Approximately 75,000 acre-feet per year of groundwater are pumped from these wells and conveyed to RID's service area west of the Agua Fria River **(Figure ES-2)**. Approximately half of this groundwater production comes from over 20 RID

[1] See A.R.S. 49-282.06.A.2, 49-282.06(B)(4)(b) and A.A.C. R18-16-407.G

production wells that are currently impacted by hazardous substances in the contaminated groundwater. Pursuant to federal and state authority, RID is pursuing this groundwater response action to mitigate the adverse impacts to its wells, operations, and water uses. The capital and operating costs of this groundwater response action are the legal liability of those parties that released or threaten to release hazardous substances that are the subject of the groundwater response action. This groundwater response action implementation plan has been prepared by Montgomery & Associates under the direction of RID's legal counsel Gallagher & Kennedy, P.A.

The specific objectives of this document are to:

- Summarize an abbreviated conceptual site model for the WVBA Site that demonstrates the need for a groundwater response action to mitigate the adverse impacts caused by the contamination and adverse impacts to RID wells, its operation, and its water uses.
- Demonstrate that a groundwater response action that uses RID's wells, conveyances, and easements (designated as the "RID Groundwater Response Action (GRA)") is the most logical, efficient, and economical approach, or **"reference remedy"** for the WVBA Site based on a preliminary analysis conducted in accordance and consistent with Arizona Administrative Code (A.A.C.) R18-16-407 and the federal National Contingency Plan (NCP) (40 CFR, Chapter 1, §300.430) for feasibility studies.
- Demonstrate that the RID GRA fully complies with the remedial objectives specified in Arizona Revised Statute (A.R.S.) 49-282.06 and is consistent with the NCP as specified in 40 CFR, Chapter 1, §300.430 and, therefore, meets all of the requirements for selection as the **preferred final remedy** for the WVBA Site.
- Establish a plan to expedite implementation of the RID GRA for the WVBA Site that includes an **Early Response Action** (ERA) conducted in accordance with A.A.C. R18-16-405. The proposed ERA would be implemented immediately and

in parallel with completion of the feasibility study, proposed remedial action plan, and record of decision (collectively designated as the "administrative requirements") associated with the selection of the final groundwater remedy as defined in Article 4 (Remedy Selection) of A.A.C. R18-16. Given the apparent preferred status of the RID GRA, this plan proposes a **streamlined approach** to meet the administrative requirements for final remedy selection. This streamlined approach will focus the required analysis, reduce the level of agency effort on review and approvals, effectively incorporate input from the community, and facilitate earlier implementation of the final groundwater remedy.

- Provide the **written rationale** for the ERA in accordance with provision C of A.A.C. R18-16-405 and be consistent with the goals of the Superfund Accelerated Cleanup Model (EPA, 1992).
- Present an overview of the **Work Plan** for the ERA, which has been prepared under separate cover in accordance with provision D of A.A.C. R18-16-405 and will be submitted to the Arizona Department of Environmental Quality (ADEQ) in September 2009.
- Present an accelerated implementation schedule for the RID GRA.

REGIONAL GROUNDWATER CONTAMINATION

Extensive regional groundwater contamination exists in the City of Phoenix from approximately 52nd Street to 75th Avenue between Lower Buckeye Road and Campbell Avenue **(Figure ES-2)**. Contaminated groundwater west of 7th Avenue and south of McDowell Road is associated with the WVBA Site and is managed by ADEQ. Contaminated groundwater north of McDowell Road between 27th Avenue and 51st Avenue is associated with the West Central Phoenix WQARF Site (WCP Site) and is also managed by ADEQ. Contaminated groundwater east of 7th Avenue is associated with the Motorola

52nd Street Superfund Site (52nd Street Site) and is managed by the U.S. Environmental Protection Agency (EPA).

Numerous potentially responsible parties (PRPs) have been identified in the WVBA Site, the 52nd Street Site, and the WCP Site where subsurface contamination is documented and where historical, current and threatened releases are suspected to represent past and ongoing sources to the regional groundwater contamination (ADEQ, 2008a, b, and c). The 52nd Street Site is subdivided into three operable units (OUs) (**Figure ES-2)**. Groundwater pump and treat systems are currently operating in OU1 and OU2 to address the groundwater contamination[2]. A groundwater response action has not been implemented in OU3. The WCP Site is subdivided into 5 operable units that correspond to distinct groundwater contamination plumes that have been delineated. To date, groundwater response actions to address the site-wide contamination have not been implemented in the WCP Site (ADEQ, 2008c). The available water quality data for the WVBA Site and assertions by ADEQ in the draft RI report indicate that contaminated groundwater continues to migrate from the 52nd Street Site and the WCP Site to the WVBA Site (Terranext, 2008a)[3].

In October 2008, ADEQ published the draft remedial investigation (RI) report for the WVBA Site (Terranext, 2008a). The RI characterized the hydrogeologic conditions, delineated the nature and extent of groundwater contamination, and identified the potential sources of the groundwater contamination based on an extensive regional investigation conducted by ADEQ and numerous facility-specific investigations conducted by the PRPs over the past 20 years. This Implementation Plan summarizes the RI results that are relevant to the proposed groundwater response action. The public comment period on the draft RI report is over and the next step in the remedy selection process for the WVBA Site is to develop the remedial objectives. Recent shortfalls in State revenue have limited the resources available to ADEQ which, in turn, is expected to adversely impact progress on the remedy selection process for the WVBA Site.

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[2] Groundwater contamination may have migrated from OU1 and OU2 to the WVBA Site before groundwater response actions were initiated.

[3] The results of the draft RI for the WVBA Site indicated that trichloroethene, 1,1-dichloroethene, and other volatile organic compounds appear to be migrating from the 52nd Street Site and WCP Sites to the WVBA Site (Terranext, 2008a).

The primary contaminants of concern (COC) in groundwater in the WVBA Site are volatile organic compounds (VOCs). The primary VOCs detected in groundwater in the WVBA Site are tetrachloroethene, trichloroethene, and 1,1-dichloroethene[4]. To a lesser extent, chromium is also considered a COC. Methyl tertiary butyl ether (MTBE) is also detected in groundwater in the vicinity of the Phoenix Fuel Terminal (Terranext, 2008a). Groundwater pumped from over 20 RID wells has detectable levels of these COCs, including two wells with MTBE. Most of these wells are impacted by COCs at levels that exceed Arizona Aquifer Water Quality Standards.

REMEDIAL OBJECTIVES

A sufficient understanding of site conditions, current and future water uses, and community expectations exists for the WVBA Site to develop preliminary remedial objectives (ROs). Accordingly, RID proposes the following ROs for the WVBA Site, which are consistent with the requirements of A.A.C., Title 18[5].

1. Protect human health and the environment by reducing and eventually eliminating potential exposure to COCs in the groundwater;
2. Restore groundwater to meet all beneficial uses including potable supply;
3. Prevent further degradation of groundwater quality by COCs;
4. Minimize the relocation, transfer, and/or volatilization of COCs from groundwater to the environment;
5. Prevent impacts to RID wells that are currently not impacted;
6. Maintain plume containment by continuing to operate the RID wells;
7. Provide all water users, with particular emphasis on RID, a water source that meets the maximum anticipated beneficial use as drinking water;

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[4] Other hazardous substances detected in groundwater in the WVBA Site, WCP Site, and Motorola 52nd Street Site include benzene, toluene, ethylbenzene, xylenes, nitrate, vinyl chloride, 1,1,1-trichloroethane, cis-1,2-dichloroethene, 1,1-dichloroethane, and chloroform

[5] See A.A.C. R-18-16-406(C)(I)

8. Maximize the beneficial use of the treated groundwater to support the goals and objectives of the Arizona Groundwater Management Act; and,
9. Provide long-term management of contaminated groundwater to improve the regional aquifer's suitability for potable use.

These preliminary ROs will be refined based on input from the community and other stakeholders during completion of the final RI report and before the feasibility study is prepared.

PROPOSED REFERENCE REMEDY

A proposed reference remedy, designated as the RID GRA, is presented in this Implementation Plan for the WVBA Site in accordance with the A.A.C.[6]. The proposed RID GRA was developed to achieve all proposed preliminary ROs and the remedial goals specified in Arizona statute[7]. **Figure ES-3** summarizes the remedial strategies, measures, and technologies considered during the development of the RID GRA. The RID GRA employs a "pump and treat" remedial approach that uses existing RID impacted wells, conveyances, and easements to the greatest extent possible. The highly favorably layout of the existing RID wells and conveyances with respect to the groundwater contamination provides unique opportunities to develop an efficient and economical regional groundwater remedy in the WVBA Site.

Table ES-1 summarizes a preliminary analysis of the RID GRA in accordance with the A.A.C.[8] As summarized in **Table ES-1** and discussed in greater detail in the complete Implementation Plan, the RID GRA is the preferred alternative because it is a comprehensive, economical, and technically feasible response action that achieves the ROs,

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[6] See A.A.C. R18-16-407(E)
[7] See A.R.S. 49-282.06
[8] See A.A.C. R18-16-407(H)

balances all aspects of the evaluation criteria, and fully complies with the remedial goals specified in Arizona statute.

Figure ES-4 depicts the proposed RID GRA layout. At full build out, the RID GRA would include: 1) a nominal 20,000 gallon per minute regional groundwater pump and treat system comprised of a new central liquid-phase granular activated carbon treatment facility and required appurtenances, 10 existing impacted RID wells, approximately 8 miles of existing RID conveyances, approximately 4 miles of new below-grade pipelines, and 2) supplemental treatment of impacted groundwater from four additional RID wells using air stripping and/or blending combined with active wellfield management to reduce VOC concentrations in water conveyed to and within the RID Main Canal to acceptable levels. The treated water from the new central groundwater treatment facility would be discharged to the RID Main Canal for irrigation use and/or conveyed to the west valley for potable use via a new pipeline constructed in existing RID easements along the RID Main Canal. During Phase 1, RID would coordinate with the Arizona Department of Water Resources to obtain and potentially operate the remediation system under a Poor Quality Groundwater Withdrawal Permit. The estimated 30-year net present value of capital and operation and maintenance costs for the RID GRA ranges from approximately $123,000,000 to $172,000,000.

The RID GRA would be implemented in 2 phases. **Table ES-2** identifies the RID wells proposed for each phase and summarizes the estimated rates of groundwater extraction, current total VOC concentrations, and the estimated VOC mass removal for each phase. Phase 1 of the RID GRA, which comprises a nominal 20,000 gallon per minute pump and treat operation, is estimated to remove over 5,700 pounds of VOCs during the early years of operation. The estimated 30-year net present value of capital and operation and maintenance costs for Phase 1 of the RID GRA ranges from approximately $111,000,000 to $130,000,000. The need for and scope of Phase 2 of the proposed RID GRA will be determined based on the degree to which Phase 1 achieves the ROs.

EARLY RESPONSE ACTION

Phase 1 of the RID GRA will be completed as an **ERA** in accordance with the A.A.C. (**Figure ES-5**)[9]. The rationale for the ERA and an overview of the ERA Work Plan are provided in the Implementation Plan. The ERA Work Plan has been prepared under separate cover and will be submitted to ADEQ in September 2009. Initiation of the ERA, which can begin immediately after approval from ADEQ and before the formal remedy selection process is completed, is needed to prevent further degradation of groundwater, protect RID wells not currently impacted, begin the regional groundwater restoration and, most importantly, begin to mitigate the adverse impact of the groundwater contamination on RID's operation. To this end, it is envisioned that approval of the ERA from ADEQ will be obtained in 2009 and implementation will occur over the ensuing 12 to 18 months.

IMPLEMENTATION PLAN

Implementation of the RID GRA will include immediate initiation of the ERA after approval of the Work Plan by ADEQ and once sufficient response action costs are available from the PRPs. In parallel with the ERA, efforts will commence on the administrative requirements (i.e., the feasibility study followed by the proposed remedial action plan) for selection of the final groundwater remedy for the WVBA Site. These administrative requirements will be conducted under a cooperative agreement with ADEQ in accordance with the A.A.C. and in a manner consistent with the federal NCP, relevant federal Superfund guidance and federal statute. It is envisioned that the effort required to complete these administrative requirements can be streamlined in light of the unique synergy that exists between the primary harmed party, RID, and the favorable disposition of its wells, conveyances, and easements as the foundation of an efficient and economical regional groundwater response action. RID will work closely with ADEQ and other stakeholders to

[9] See A.A.C. R-18-16-405

develop this streamlined approach, which will focus the necessary analyses, effectively involve the community and other stakeholders, and ultimately lead to a regional groundwater response action that addresses one of the largest groundwater contamination plumes in the United States and provides a secure source of remediated water that can be used for all beneficial uses including potable supply.

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TABLE ES-1
PRELIMINARY ANALYSIS OF ROOSEVELT IRRIGATION DISTRICT GROUNDWATER RESPONSE ACTION

ROOSEVELT IRRIGATION DISTRICT
GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN WATER QUALITY ASSURANCE REVOLVING FUND SITE

REMEDIAL ALTERNATIVE	REMEDIAL STRATEGIES	REMEDIAL MEASURES	REMEDY COMPONENTS	REMEDIAL OBJECTIVE ACHIEVEMENT	CONSISTENCY WITH LAND AND WATER USE PLANS	COMPARISON CRITERIA			
						Practicability	Risk	Benefit	Estimated Cost
Reference Remedy: **Roosevelt Irrigation District (RID) Groundwater Response Action** **Phase 1 - Early Response Action** - nominal 20,000 gallon per minute (gpm) extraction and treatment system **Phase 2 - Supplemental Response Actions** - manage operation of remaining impacted RID wells to maintain contaminants of concern (COC) concentrations below AWQSs or other appropriate standards through treatment, blending, and/or priority pumping	Plume Remediation, Plume Containment, Source Control, and Monitoring *note: assumes source control in the West Van Buren Area (WVBA) Site is conducted by potentially responsible parties (PRPs) and sources upgradient of the WVBA Site are addressed under Federal Superfund Program by the Environmental Protection Agency (EPA).*	Groundwater extraction; impacted water conveyance; central, local, and/or wellhead treatment; treated water discharge for all beneficial uses; sampling, lab analysis, and reporting	Treat impacted groundwater from up to 16 existing RID production wells; wellhead improvements; use approximately 8 miles of existing RID pipelines/canals; install approximately 4 miles of new below-grade pipelines; construct and operate a new nominal 20,000 gpm central groundwater treatment facility using granular activated carbon; construct and operate local and/or wellhead treatment systems using air stripping with sufficient capacity to meet discharge goals in a coordinated program of treatment, blending, and/or priority pumping; obtain operating permit; monitor system performance and report results	Expected to achieve all preliminary ROs by removing COCs through extraction and treatment; protects human health and environment; prevents public exposure to COCs in groundwater; restores groundwater quality; prevents further groundwater contamination and protects unimpacted RID wells via source control and hydraulic plume containment; limits volatilization of VOCs from groundwater to air; results in a secure source of remediated water that is acceptable for all beneficial uses through permitted treatment, monitoring, and discharge	Minimal impact on land use in WVBA Site because remedy uses largely existing RID infrastructure; new pipelines will be installed in existing RID easements or new easements on public or private property; treatment facilities will likely require permits, property purchases or long-term access agreements; remedy consistent with all water use plans by restoring groundwater quality to meet all beneficial uses; significant declines in regional water levels not expected based on historical data	High degree of practicability; remedy uses existing infrastructure to the greatest extent possible; uses effective technologies that are proven and reliable; permits and access for new infrastructure can likely be obtained; professional services to design, construct, and operate remedy are available	Risks to public are effectively managed; remedy protects human health and environment over long-term through containment of impacted groundwater, extraction, and treatment; residual risk during remedy implementation and after remedy completion manageable; monitoring will ensure compliance with applicable State and Federal water quality standards	High degree of benefit; remedy restores groundwater quality; reduces risk to public and environment through treatment; mitigates impact on RID's operation and water supply and protects unimpacted wells; high degree of public acceptance expected; treated water available as a secure source of high quality water	**PHASE 1** Capital Cost: **$34 MM** Annual O&M Cost: **$4 - $5 MM** 30-Year NPV O&M Cost: **$77 - $96 MM** Total Cost: **$111 - $130 MM** **PHASE 2** Capital Cost: **$5 - $13 MM** Annual O&M Cost: **$0.4 - $1.5 MM** 30-Year NPV O&M Cost: **$8 - $29 MM** Total Cost: **$13 - $42 MM** **TOTAL** Capital Cost: **$39 - $47 MM** Annual O&M Cost: **$4.4 - $5.5 MM** 30-Year NPV O&M Cost: **$85 - $125 MM** Total Cost: **$124 - $172 MM**

Footnotes:
MM - Millions of dollars
O&M - Operation and maintenance
NPV = Net present value

TABLE ES-2
SUMMARY OF PROPOSED ROOSEVELT IRRIGATION DISTRICT GROUNDWATER RESPONSE ACTION

ROOSEVELT IRRIGATION DISTRICT
GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN AREA WATER QUALITY ASSURANCE REVOLVING FUND SITE

PHASE		WELL NAME	ESTIMATED PUMPING RATE (gallons per minute) [1]	TOTAL VOC CONCENTRATION (micrograms per liter) [2]		ESTIMATED MASS OF TOTAL VOCs REMOVED (pounds per year)[3]
PHASE 1 EARLY RESPONSE ACTION	1A Pump and treat impacted groundwater from RID wells located along Van Buren Street	RID-105	1,900		5	44
		RID-106	1,500		61	397
		RID-107	2,100		51	464
		RID-108	1,900		63	526
		RID-109	2,400		22	234
		RID-110	2,900		14	180
		RID-112	1,700		31	231
		RID-113	2,300		44	443
		RID-114	2,500		110	1,202
		SUBTOTAL	19,200	AVG [4]	44	3,722
	1B Pump and treat impacted groundwater from RID wells with highest VOC concentrations	RID-89 [5]	2,900		51	652
		RID-92	1,200		119	624
		RID-95 [5]	1,700		80	593
		RID-100	2,100		65	599
		RID-106	1,500		61	397
		RID-107	2,100		51	464
		RID-108	1,900		63	526
		RID-112	1,700		31	231
		RID-113	2,300		44	443
		RID-114	2,500		110	1,202
		SUBTOTAL	19,900	AVG [4]	66	5,732
PHASE 2 SUPPLEMENTAL RESPONSE ACTIONS Enhanced wellfield management to reduce VOC concentrations in impacted groundwater discharged to RID Main Canal to acceptable levels by treatment, blending, and/or priority pumping		RID-84	2,400	The degree of treatment required to meet the Phase 2 objectives is unknown at this time. For planning and cost estimating purposes, it was assumed that four low-profile air strippers would be constructed to treat impacted groundwater from RID wells 84, 99, 102, and 104. In this case, an estimated total of approximately 600 pounds of total VOCs would be treated annually from Phase 2 operations.			
		RID-99	2,400			
		RID-102	3,900			
		RID-104	3,600			
		RID-109 [6]	2,400			
		RID-110 [6]	2,900			
		RID-111	see note 7			
		SUBTOTAL	17,600			
TOTAL (PHASES 1B AND 2)			37,500	AVG [4]	35	5,732

Footnotes:
1 - Pumping rates based on data provided by RID for 2008 and 2009.
2 - Sum of all detected VOCs; concentrations based on most recent analytical data available for each well.
3 - Total VOC removal in early years of remedy assuming all impacted wells from Phase 1A and 1B are pumped continously and all water is treated; actual mass removal may vary depending on demand for treated water.
4 - Pumping rate weighted average concentration in micrograms per liter assuming no loss due to volatilization or degradation.
5 - Pumping rates shown are 75% of reported rates; well testing and modification may be conducted to seal off lower portion of wells to optimize pumping of impacted groundwater.
6 - Wellhead and/or discharge infrastructure modifications may be required to blend impacted water from these wells with clean water from RID-88 and RID-91 before discharge to RID Main Canal.
7 - RID-111 is currently inoperable. A new replacement well may be drilled outside the plume to restore the lost water supply from RID-111 to RID.
Abbreviations:
RID - Roosevelt Irrigation District
VOC - Volatile organic compounds

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R. 1 E. R. 2 E. R. 3 E.

T. 2 N.

T. 1 N.

Camelback Rd
Campbell Ave
Indian School Rd
Thomas Rd
McDowell Rd
Van Buren St
Buckeye Rd
Lower Buckeye Rd
Broadway Rd

Salt River Project Grand Canal
RID Main Canal
RID Salt Canal
Salt River

West Central Phoenix WQARF Site

West Van Buren Area WQARF Site

Motorola 52nd Street Superfund Site Operable Unit 3 Boundary

City of Phoenix 23rd Avenue WWTP

RID-83 RID-84 RID-85 RID-86 RID-87 RID-88 RID-89 RID-90 RID-91 RID-92 RID-93 RID-94 RID-95 RID-96 RID-97 RID-98 RID-99 RID-100 RID-101 RID-102 RID-103 RID-104 RID-105 RID-106 RID-107 RID-108 RID-109 RID-110 RID-111 RID-112 RID-113 RID-114

101 10 17 51 202

Grand Ave

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

Sky

EXPLANATION

- Roosevelt Irrigation District Well
- Monitor Well
- Existing Canal or Pipeline
- Interstates
- Local Streets
- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Abbreviations
WVBA - West Van Buren Area
WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District

N

0 5,000 Feet

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Study Area

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FIGURE ES-1

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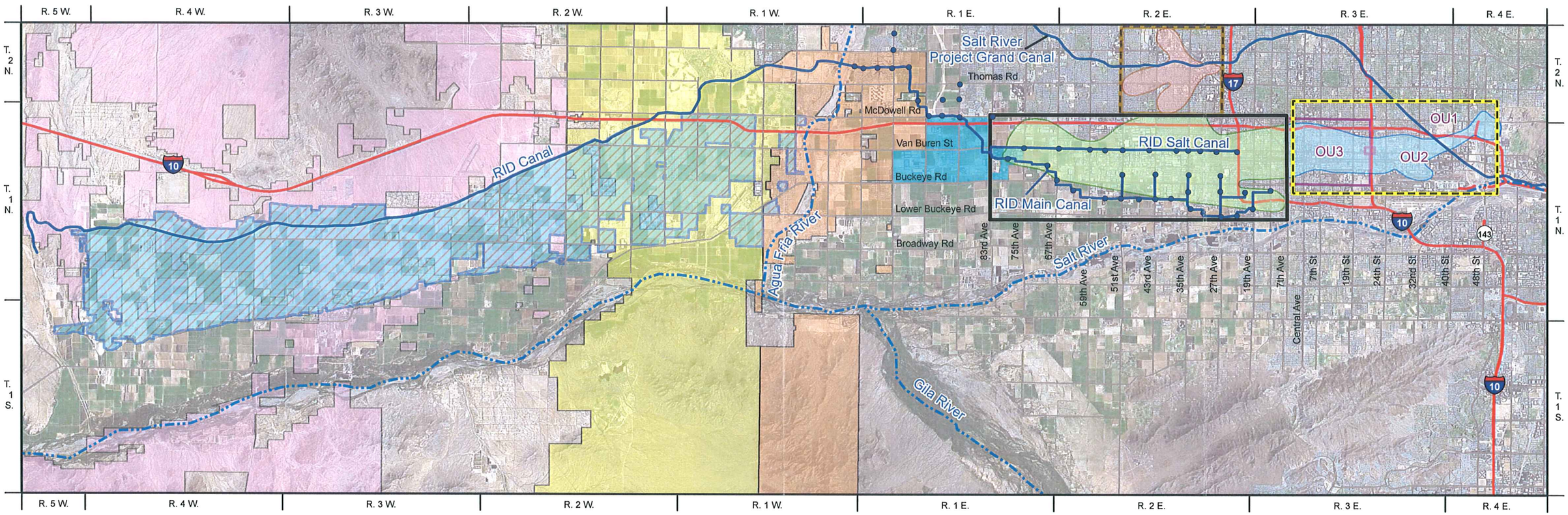

EXPLANATION

- Roosevelt Irrigation District
- City of Goodyear Boundary
- City of Avondale Boundary
- Town of Buckeye Boundary
- City of Tolleson Boundary
- Interstates
- Local Streets
- Roosevelt Irrigation District Well
- West Van Buren WQARF Site
- Motorola 52nd Street Superfund Site
- West Central Phoenix WQARF SIte
- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Abbreviations

WQARF - Water Quality Assurance Revolving Fund
OU - Operable Unit
RID - Roosevelt Irrigation District

N

0 3
Miles

DRAFT

Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Regional Conditions

2009

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FIGURE ES-2

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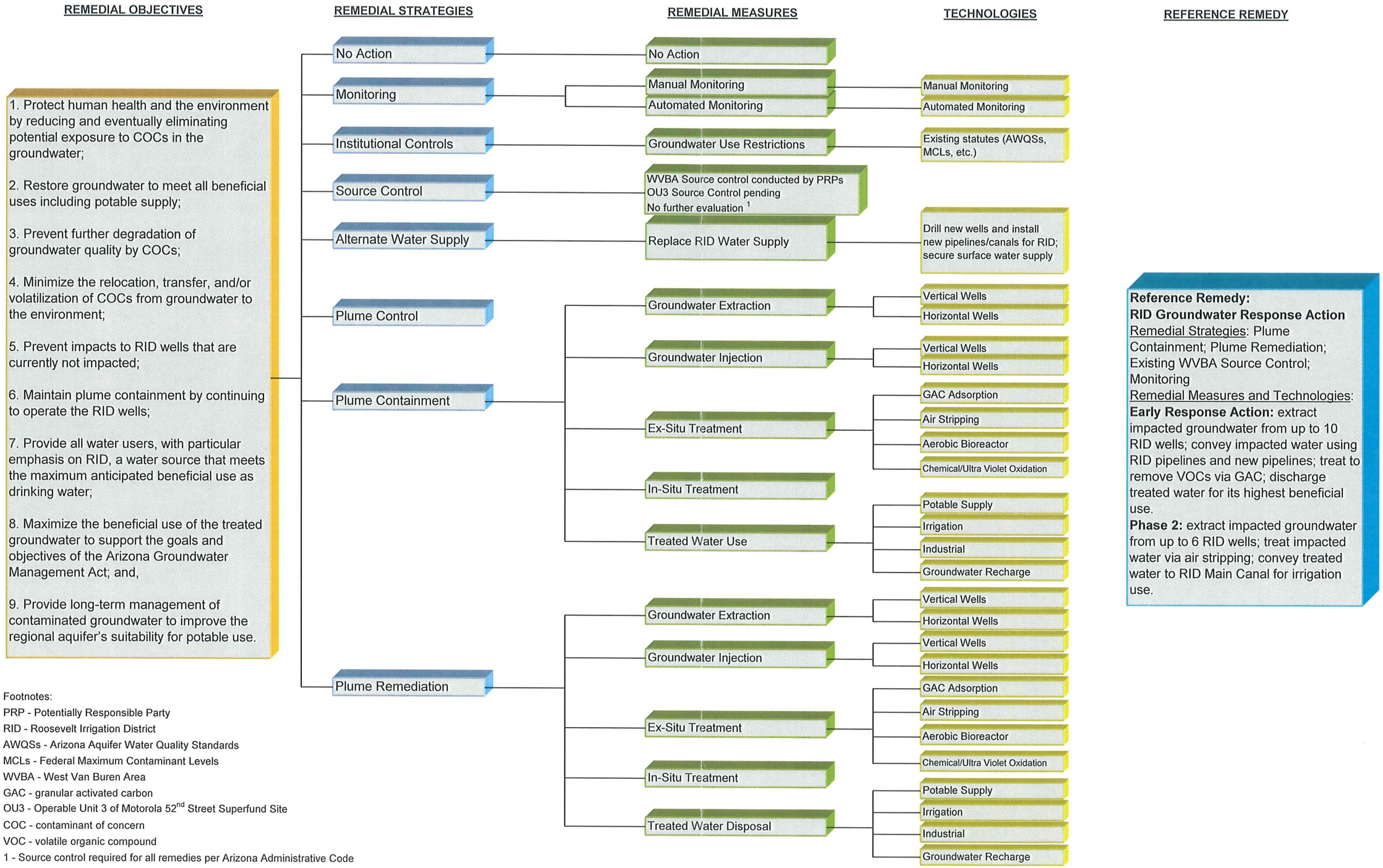

Footnotes:
PRP - Potentially Responsible Party
RID - Roosevelt Irrigation District
AWQSs - Arizona Aquifer Water Quality Standards
MCLs - Federal Maximum Contaminant Levels
WVBA - West Van Buren Area
GAC - granular activated carbon
OU3 - Operable Unit 3 of Motorola 52nd Street Superfund Site
COC - contaminant of concern
VOC - volatile organic compound
1 - Source control required for all remedies per Arizona Administrative Code

FIGURE ES-3. DEVELOPMENT OF REFERENCE REMEDY
ROOSEVELT IRRIGATION DISTRICT GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN AREA WATER QUALITY REVOLVING FUND SITE

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R. 1 E. R. 2 E. R. 3 E.

T. 2 N.

T. 1 N.

Camelback Rd.
Indian School Rd
Thomas Rd
McDowell Rd
Van Buren St
Buckeye Rd
Lower Buckeye Rd
Broadway Rd

101 17 51 10 202

Campbell Ave.
Salt River Project Grand Canal
Grand Ave
RID Main Canal
RID Salt Canal
Proposed Treatment Plant

West Central Phoenix WQARF Site

Motorola 52nd Street Superfund Site Operable Unit 3 Boundary

West Van Buren Area WQARF Site

RID-105 1,900 5
RID-106 1,500 61
RID-107 2,100 51
RID-108 1,900 63
RID-109 2,400 22
RID-110 2,900 14
RID-111 Inoperable
RID-112 1,700 31
RID-113 2,300 44
RID-114 2,500 110
RID-83 2,300 NS
AS RID-84 2,400 12
RID-85 2,600 ND
RID-86 3,600 ND
RID-87 2,000 NS
RID-88 2,000 ND
RID-89 3,900 51
RID-90 2,500 NS
RID-91 3,200 NS
RID-92 1,200 119
RID-93 4,000 ND
RID-94 3,300 3
RID-95 2,300 80
RID-96 3,000 NS
RID-97 3,200 ND
RID-98 3,800 NS
RID-99 2,400 11
RID-100 2,100 65
RID-101 4,500 2
RID-102 3,900 12
RID-103 2,200 2
RID-104 3,600 11

City of Phoenix 23rd Avenue WWTP

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

Salt River

Sky

EXPLANATION

Roosevelt Irrigation District Well
RID-89 - Well ID
3,900 - Estimated Pumping Rate (gpm)
51 - Total 2008 VOC Concentration (ug/L)
(ND = Not Detected, NS = Not Sampled)

Existing Canal or Pipeline
Proposed New Below-Grade Pipeline
Interstates
Local Streets

Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Monitor Well

Abbreviations
WVBA - West Van Buren Area
WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District
gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
OU3 - Operable Unit 3

Phase 1 (Early Response Action)
Phase 2 (Supplemental Response Actions)
AS Wellhead Air Stripper

N

0 5,000
Feet

DRAFT

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Proposed Roosevelt Irrigation District Groundwater Response Action

MONTGOMERY & ASSOCIATES
Water Resource Consultants

2009

FIGURE ES-4

R. 1 E. R. 2 E. R. 3 E.

T. 2 N.

T. 1 N.

Camelback Rd
Campbell Ave
Indian School Rd
Thomas Rd
McDowell Rd
Buckeye Rd
Lower Buckeye Rd
Broadway Rd

101 17 51 10 202

Salt River Project Grand Canal

West Central Phoenix WQARF Site

Grand Ave

Motorola 52nd Street Superfund Site Operable Unit 3 Boundary

RID Main Canal

Proposed Treatment Plant

Van Buren St

RID Salt Canal

RID-105 1,900 5
RID-106 1,500 61
RID-107 2,100 51
RID-108 1,900 63
RID-109 2,400 22
RID-110 2,900 14
RID-111 Inoperable
RID-112 1,700 31
RID-113 2,300 44
RID-114 2,500 110
RID-83 2,300 NS
RID-84 2,400 12
RID-85 2,600 ND
RID-86 3,600 ND
RID-87 2,000 NS
RID-88 2,000 ND
RID-89 3,900 51
RID-90 2,500 NS
RID-91 3,200 NS
RID-92 1,200 119
RID-93 4,000 ND
RID-94 3,300 3
RID-95 2,300 80
RID-96 3,000 NS
RID-97 3,200 ND
RID-98 3,800 NS
RID-99 2,400 11
RID-100 2,100 65
RID-101 4,500 2
RID-102 3,900 12
RID-103 2,200 2
RID-104 3,600 11

West Van Buren Area WQARF Site

City of Phoenix 23rd Avenue WWTP

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

Salt River

Sky

EXPLANATION

- Roosevelt Irrigation District Well
  - RID-89 - Well ID
  - 3,900 - Estimated Pumping Rate (gpm)
  - 51.4 - Total 2008 VOC Concentration (ug/L)
  - (ND = Not Detected, NS = Not Sampled)
- Existing Canal or Pipeline
- Proposed New Below-Grade Pipeline
- Interstates
- Local Streets

- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site
- Monitor Well

Abbreviations

WVBA - West Van Buren Area
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gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
OU3 - Operable Unit 3

Early Response Action
(see Table 2 for a summary of phased implementation)

N

0 5,000 Feet

DRAFT

Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Early Response Action

2009

MONTGOMERY & ASSOCIATES
Water Resource Consultants

FIGURE ES-5

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AVERY

MONTGOMERY & ASSOCIATES

September 25, 2009
DRAFT

ROOSEVELT IRRIGATION DISTRICT GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN WEST VAN BUREN WATER QUALITY ASSURANCE REVOLVING FUND SITE

INTRODUCTION

This document outlines an evaluation of and conceptual implementation plan for a response action to address the groundwater contamination in the West Van Buren Area (WVBA) Water Quality Assurance Revolving Fund (WQARF) Site (the WVBA Site) that currently impacts or threatens to impact Roosevelt Irrigation District (RID) wells, its operations, and the unrestricted use of its water supply. Groundwater within the WVBA Site is impacted by organic and inorganic compounds as a result of historical and current releases and threatened releases of hazardous substances from numerous industrial facilities located in the Phoenix area. **Figure 1** depicts the boundaries of, relevant features within, and a composite extent of groundwater contamination in the WVBA Site.

The groundwater contamination in the WVBA Site has impacted or threatens to impact 32 production wells owned by the RID. RID currently pumps approximately 75,000 acre-feet per year (AFY) of groundwater from 31 of these wells (RID-111 is currently inoperable) and conveys it to its service area west of the Agua Fria River **(Figure 2)**. Approximately half of this groundwater production comes from over 20 RID production wells that are currently impacted by the groundwater contamination. This groundwater response action is required to restore the groundwater quality within the WVBA Site to

protect public health and the environment and meet all beneficial uses. Specifically, this groundwater response action is required to mitigate the adverse impacts to RID's wells, its operations, and its water uses.

The specific objectives of this document are to:

- Summarize an abbreviated conceptual site model (CSM) for the WVBA Site that demonstrates the need for a groundwater response action to mitigate the adverse impacts caused by the contamination and adverse impacts to RID wells, its operation, and its water uses.
- Demonstrate that a groundwater response action that uses RID's wells, conveyances, and easements (designated as the "RID Groundwater Response Action (GRA)") is the most logical, efficient, and economical approach, or "**reference remedy**" for the WVBA Site based on a analysis conducted in accordance and consistent with Arizona Administrative Code (A.A.C.) R18-16-407 and the federal National Contingency Plan (NCP) (40 CFR, Chapter 1, §300.430) for feasibility studies.
- Demonstrate that the RID GRA fully complies with the remedial objectives specified in Arizona Revised Statute (A.R.S.) 49-282.06 and is consistent with the NCP as specified in 40 CFR, Chapter 1, §300.430 and, therefore, meets all of the requirements for selection as the **preferred final remedy** for the WVBA Site.
- Establish a plan to expedite implementation of the RID GRA for the WVBA Site that includes an **Early Response Action** (ERA) conducted in accordance with A.A.C. R18-16-405. The proposed ERA would be implemented immediately and in parallel with completion of the feasibility study (FS), proposed remedial action plan (PRAP), and record of decision (ROD) (collectively designated as the "administrative requirements") associated with the selection of the final groundwater remedy as defined in Article 4 (Remedy Selection) of A.A.C. R18-16. Given the apparent preferred status of the RID GRA, this plan proposes

a **streamlined approach** to meet the administrative requirements for final remedy selection. This streamlined approach will focus the required analysis, reduce the level of agency effort on review and approvals, effectively incorporate input from the community, and facilitate earlier implementation of the final groundwater remedy.

- Provide the **written rationale** for the ERA in accordance with provision C of A.A.C. R18-16-405 and be consistent with the goals of the Superfund Accelerated Cleanup Model (SACM) (EPA, 1992).
- Present an overview of the **Work Plan** for the ERA, which has been prepared under separate cover in accordance with provision D of A.A.C. R18-16-405 and will be submitted to the Arizona Department of Environmental Quality (ADEQ) in September 2009.
- Present an accelerated implementation schedule for the RID GRA.

The subsequent portion of this document is subdivided into the following sections:

- Background Information
- Conceptual Site Model
- Preliminary Remedial Objectives
- Preliminary Development and Analysis of Remedial Alternatives
- Implementation Plan
- Summary

BACKGROUND INFORMATION

This section provides an overview of the regional extent of groundwater contamination in the vicinity of and within the WVBA Site.

REGIONAL GROUNDWATER CONTAMINATION

Extensive regional groundwater contamination exists in the City of Phoenix (COP) from approximately 52nd Street to 75th Avenue between Lower Buckeye Road and Campbell Avenue **(Figure 2)**. The groundwater in this area is impacted primarily by volatile organic compounds (VOCs) resulting from historical and current releases and threatened releases to the subsurface from numerous industrial facilities. Impacted groundwater east of 7th Avenue is being managed by the United States Environmental Protection Agency (EPA) under the federal Superfund program and is designated as the Motorola 52nd Street Superfund Site (52nd Street Site). From east to west, the 52nd Street Site is subdivided into three operable units (OUs), with the area between 52nd Street and 44th Street designated as OU1, the area between 44th and 20th Street designated as OU2, and the area between 20th Street and 7th Avenue designated as OU3 **(Figure 2)**.

Groundwater pump and treat systems are currently operating in OU1 and OU2 to address impacted groundwater within these OUs. To date, an operable unit-wide groundwater response action has not been implemented in OU3; therefore, impacted groundwater continues to migrate from OU3 to the WVBA Site. Numerous potentially responsible parties (PRPs) have been identified in OU1, OU2, and OU3 where historical and current releases, threatened releases, and documented subsurface contamination are suspected to represent past and ongoing sources of groundwater contamination in the Superfund site operable units and downgradient in the WVBA Site (ADEQ, 2008a).

The impacted groundwater that exists north of McDowell Road between 27th and 51st Avenues is associated with the West Central Phoenix WQARF Site (WCP Site) and is being managed by ADEQ. The WCP Site is subdivided into 5 operable units: 1) East Grand Avenue, 2) West Grand Avenue, 3) North Plume, 4) North Canal Plume, and 5) West Osborn Complex. Impacted groundwater in the West Osborn Complex exists immediately north and nominally upgradient of the WVBA Site. Numerous PRPs have been identified in the WCP Site where historical and current releases, threatened releases, and documented subsurface contamination are suspected to represent past and ongoing sources of groundwater contamination in the WCP Site and downgradient in the WVBA Site (ADEQ, 2008c)[10]. To date, a regional response action to mitigate the impacted groundwater in the WCP Site operable units has not been implemented.

The WVBA Site is located immediately west of the Motorola 52nd Street Superfund Site and south of the WCP Site **(Figure 2)**. The groundwater plume that extends from the Motorola 52nd Street facility to 75th Avenue is one of the largest in the United States.

WEST VAN BUREN AREA SITE

The WVBA Site was informally established in 1987 and then formally registered as a WQARF site in 1998 (ADEQ, 2008b). The WVBA Site is approximately 8 miles long and 1.5 miles wide. The site comprises approximately 12 square miles within the western portion of the COP, and is generally bounded on the north by Interstate 10, on the east by 7th Avenue, on the south by Lower Buckeye Road, and on the west by 75th Avenue. The City of Tolleson is located immediately west of the WVBA Site.

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[10] ADEQ reported at its January 18, 2008 WQARF Board meeting that the West Osborn Complex is currently in the FS stage and that impacted groundwater from this operable unit was more extensive than originally thought and probably has merged with the WVBA Site. Also, the results of the draft RI for the WVBA Site indicated that trichloroethene, 1,1-dichloroethene, and other volatile organic compounds appear to be migrating from the WCP Sites to the WVBA Site (Terranext, 2008a).

Extensive groundwater investigations were conducted from 1987 through 2008 by ADEQ during the WVBA Site remedial investigation (RI). In addition, approximately 50 facility-specific soil and/or groundwater investigations were conducted by PRPs at suspected source areas within the WVBA Site during the same time period. In October 2008, ADEQ published the draft RI report for the WVBA Site (Terranext, 2008a). The draft RI report summarizes the following information:

- Results of the WVBA Site-wide groundwater investigation;
- Results of the subsurface investigations conducted by PRPs;
- Results of remedial activities completed by PRPs;
- Surface water, geologic, hydrogeologic, and ecologic conditions;
- Nature and extent of contamination;
- Impacts to RID's wells and fate and transport of contaminants in its conveyance system; and
- Contaminant fate and transport in groundwater.

The public comment period for the draft RI Report began on November 1 and ended December 31, 2008. Comments on the draft RI report were provided by five parties including: 1) Brown & Caldwell on behalf of Dolphin Industries, 2) the EPA, 3), Lindon Park Neighborhood Association, 4) Univar USA, Inc., and 5) RID. ADEQ is currently reviewing the public comments.

The draft RI report included the December 2007 Land and Water Use Report for the WVBA Site (Terranext, 2007). The Land and Water Use Report is a required component of the RI under provision A3 of A.A.C. R18-16-406. The Land and Water Use study included the distribution of a standardized questionnaire to local businesses and other parties to identify current and reasonably foreseeable future uses of land and waters of the state within the WVBA Site. The results of the Land and Water Use study will be used to establish the **remedial objectives (ROs)** for the WVBA Site.

The next steps in the remedy selection process for the WVBA Site are to respond to the public comments on the draft RI report, develop preliminary ROs based in part on community input, prepare the draft and final ROs reports, and prepare the final RI report. After completion of the final RI report, ADEQ will commence work on the FS, followed by the PRAP. Based on the results of the FS and PRAP, ADEQ will select the final remedy for the WVBA Site and declare it in the ROD.

Recent revenue shortfalls in Arizona have resulted in budget reductions and spending freezes in state government. The current budget constraints have limited forward progress on the WVBA Site by ADEQ and its contractor Terranext, which will result in a delay in the selection and startup of the final groundwater remedy for the WVBA Site. It is unknown when funds will be available to fully restore forward progress on the WVBA Site under the WQARF program.

CONCEPTUAL SITE MODEL

As depicted on **Figure 3**, an abbreviated CSM was developed based on information presented in the draft RI report and a variety of additional technical information (Terranext, 2007, 2008a, 2008b and ADEQ, 2008b). The primary objective of developing the abbreviated CSM was to concisely summarize the relevant WVBA Site conditions that are integral to evaluating, selecting and implementing the groundwater response action. To this end, the abbreviated CSM briefly summarizes the following attributes of the WVBA Site: 1) physical setting, 2) hydrogeologic conditions, 3) groundwater conditions, 4) nature and extent of contamination, 5) sources of contamination and 5) impact on RID operations. Additional details on the CSM are provided in the draft RI report (Terranext, 2008a).

PHYSICAL SETTING

The relevant aspects of the physical setting in the WVBA Site include current and future land uses and surface water conditions.

Land Uses

The WVBA Site is located in the western portion of the COP. The area within the WVBA Site is largely urbanized. The urban density is currently highest in the east near the city center and lowest in the west where substantial active and retired agricultural lands exist. New industrial complexes are being developed in the western portion of the WVBA Site. The primary current land uses in the WVBA Site identified in the Land and Water Use study include agricultural/vacant, industrial, warehouse, transportation, residential, and mixed commercial/public (Terranext, 2007). The population in the WVBA Site is expected to increase in the future with the largest increases occurring in the west; therefore, residential

land use is expected to increase proportionately compared to the other land uses. The land uses of the respondents to the land use questionnaires, who were largely industrial in nature, are not expected to change significantly in the future.

Surface Water

The Salt River is located south of the WVBA Site. Localized flow occurs in the Salt River south of the eastern portion of the WVBA Site as a result of treated wastewater releases from the COP's 23rd Avenue Waste Water Treatment Plant (WWTP). More extensive flow in the Salt River in the area south of the WVBA Site can occur periodically as a result of runoff from heavy precipitation events. A portion of this flow in the Salt River recharges the groundwater in the area south of the WVBA Site. This recharge can affect groundwater levels, hydraulic gradients, and groundwater flow directions within the WVBA Site.

RID operates its primary canal, designated as the "RID Main Canal", in the southern portion of the WVBA Site to convey irrigation water to its service area west of the Agua Fria River **(Figure 2)**. The RID Main Canal extends from approximately 19th Avenue and Interstate 17, through the cities of Phoenix, Tolleson, Avondale and Goodyear to its terminus west of Buckeye (approximately 32 miles west of the WVBA Site). The RID Main Canal conveys a mixture of treated wastewater from the COP 23rd Avenue WWTP and groundwater pumped from the WVBA Site and adjacent areas to the agricultural land in Goodyear and Buckeye. The RID Main Canal receives a nominally continuous discharge of approximately 25,000 to 30,000 AFY of treated wastewater, approximately 37,000 AFY of groundwater from RID wells within the WVBA Site that are impacted by the groundwater contamination, and approximately 38,000 AFY of groundwater from RID wells within the WVBA Site that are currently not impacted by the groundwater contamination. The majority of this groundwater pumping occurs during the peak irrigation demand season that extends from March to September.

Approximately 15,000 AFY of the impacted groundwater conveyed to the RID Main Canal are currently pumped from RID wells along Van Buren Street and are conveyed to the RID Main Canal in what is known as the RID "Salt Canal". The Salt Canal extends from approximately Interstate 17 to 83rd Avenue. The Salt Canal is predominantly a below-grade pipe with a few short sections of open canal that exist below and adjacent to Van Buren Street. Flow from the Salt Canal discharges to the RID Main Canal near 83rd Avenue between Van Buren Street and Washington Street. RID also operates several smaller pipelines and open canals within the WVBA Site to convey groundwater from RID wells to the RID Main Canal.

HYDROGEOLOGIC CONDITIONS

The WVBA Site is located within the West Salt River Valley (SRV). The SRV is an alluvial basin consisting of unconsolidated to semi-consolidated sediments typical of Basin and Range physiography. These sediments are up to several thousand feet thick in the center of the basin and range in size from clay to cobbles, with some evaporite deposits (Terranext, 2008a). In general, the SRV is subdivided into three hydrogeologic units from shallowest to deepest: 1) Upper Alluvial Unit (UAU), 2) Middle Alluvial Unit (MAU), and 3) Lower Alluvial Unit (LAU) **(Figure 3)**. The units of primary interest in the WVBA Site are the UAU and MAU. It is reported in the draft RI report that the LAU does not currently appear to be impacted in the WVBA Site; although limited data exist to characterize the LAU (Terranext, 2008a). The LAU is not discussed in detail in this report.

An analysis of lithologic logs from approximately 200 monitor wells and other types of wells was conducted for the WVBA Site during the RI (Terranext, 2008a). Based on this analysis, the UAU within the WVBA Site was further divided into two subunits designated as the UAU1 and UAU2. The UAU1 is comprised of loose surface soil grading downward into interfingered sand, gravel, and thin clayey sand lenses. The UAU1 ranges in thickness

from approximately 170 to 310 feet. In general, the UAU1 exhibits higher percentages of fine-grained sediments west of 75th Avenue and in the northern portion of the WVBA Site.

The UAU2 is generally composed of fine grained sediments with large percentages of clay. The top of the UAU2 is encountered at depths ranging from approximately 170 to 310 feet below land surface (bls). The UAU2 ranges in thickness from approximately 30 to 260 feet, with the thickest portion existing in the western portion of the WVBA Site. In general, the UAU2 is more fine-grained west of 67th Avenue and in the southern portion of the WVBA Site.

The MAU is identified below the UAU2 based on a lithologic sequence characterized by at least approximately 40 feet of hard brown clay or sticky brown clay. Below this sequence, the MAU is composed predominantly of fine-grained sediments. The MAU is encountered at depths ranging from approximately 260 to 500 feet bls. The total thickness of the MAU was not reported in the draft RI report.

GROUNDWATER CONDITIONS

Groundwater conditions in the WVBA area have been monitored periodically since 1993 as part of the RI. Groundwater within the WVBA Site generally occurs under unconfined conditions in the UAU and under semi-confined to confined conditions in the MAU. Groundwater levels in the UAU have declined approximately 35 feet in the monitor wells within the WVBA Site based on groundwater monitoring conducted during the RI from 1993 to present. The rate of groundwater level decline was estimated to be approximately 3 feet per year and corresponds to drier than normal precipitation conditions that have prevailed since 1995. On an annual basis, groundwater levels in the WVBA Site vary seasonally with the highest water levels observed in the winter and lowest water levels observed in the summer. These fluctuations are due primarily to seasonal variations in

groundwater pumping from the RID wells and are most prevalent in the central and western portions of the WVBA Site.

In the 1st quarter of 2008, the depth to groundwater in the WVBA Site in the UAU1 ranged from approximately 91 feet bls in the eastern portion of the site to approximately 137 feet bls in the western portion of the site. For the same time period, the groundwater altitude in the WVBA Site in the UAU1 ranged from approximately 987 feet above mean sea level (feet amsl) in the eastern portion of the site to approximately 915 feet amsl in an apparent local groundwater depression in the western portion of the site. The depth to groundwater in the WVBA Site in the UAU2 ranged from approximately 92 feet bls on the east to approximately 128 feet bls on the west. For the same time period, the groundwater altitude in the WVBA Site in the UAU2 ranged from approximately 984 feet amsl in the eastern portion of the site to approximately 911 feet amsl in the western portion of the site. The depth to groundwater in the WVBA Site in the MAU ranged from approximately 92 feet bls on the east to approximately 128 feet bls on the west. For the same time period, the groundwater altitude in the WVBA Site in the MAU ranged from approximately 980 feet amsl in the eastern portion of the site to approximately 906 feet amsl in the western portion of the site.

The prevailing groundwater flow direction in UAU1, UAU2, and MAU is generally to the west, although groundwater flow directions can vary locally and seasonally in all directions due to recharge and groundwater pumping from the RID wells. The largest deviations from the prevailing westerly groundwater flow direction are observed in the central and western portions of the WVBA Site in close proximity to the RID wells.

Based on 1st quarter 2008 groundwater elevation contour maps reported in the RI, the horizontal hydraulic gradients vary from east to west within the WVBA Site in the UAU1 and UAU2. The average horizontal hydraulic gradient in both of these units across the WVBA Site is approximately 0.002 feet per foot, or approximately 13 feet of groundwater

elevation drop per mile. The horizontal hydraulic gradients in UAU1 and UAU2 are generally steepest in the eastern and western portions of the WVBA Site and flattest in the central portion of the site. Localized steep gradients can occur near the RID pumping wells in the UAU1 and UAU2. The average horizontal gradient in the MAU is approximately 0.003 feet per foot, or approximately 14 feet of groundwater elevation drop per mile. The horizontal hydraulic gradient in the MAU is relatively uniform across most of the WVBA Site with a slight steepening in the western portion of the site.

A number of paired monitor well sets have been constructed in the WVBA Site to estimate the vertical gradients. In general, a downward vertical gradient prevails over large portions of the WVBA Site, although localized areas of upward vertical gradients also exist within the WVBA Site. The vertical gradients appear to vary in magnitude and direction seasonally, probably due to seasonal changes in pumping from the RID wells.

Heterogeneities in the sediments throughout the SRV and in the WVBA Site result in variations in the hydraulic properties of the UAU, MAU, and LAU. Locally within the WVBA Site, the estimated hydraulic conductivities of the UAU, MAU and LAU are 5 to 700 feet per day (ft/day), 7 to 30 ft/day, and 3 to 20 ft/day, respectively (Terranext, 2008a). The specific yield of the UAU is estimated to range from 0.08 to 0.20. Within the deeper portions of the UAU, which exhibit semi-confined conditions, the storage coefficient is estimated to range from 0.009 to 0.02. The confined storage coefficient of the MAU and LAU are estimated to range from 0.0003 to 0.00005 and 0.001 to 0.0009, respectively.

Based on the average horizontal hydraulic gradient and range of estimated hydraulic conductivities reported in the draft RI report for the UAU1, and assuming an effective porosity of 0.3, the average horizontal groundwater velocities in the largely coarse-grained UAU1 are estimated to range from 15 to over 2,000 feet per year (ft/yr). The average groundwater velocities in the fine grained UAU2 and MAU are estimated to be less than 100 ft/yr.

Recharge in the WVBA Site occurs from infiltration of excess irrigation water from agricultural lands, leakage from irrigation canals, and infiltration of treated wastewater and surface water runoff in the Salt River.

Groundwater pumping by RID represents the primary discharge from the WVBA Site. RID has operated approximately 52 large irrigation wells east of the Agua Fria River since the late 1920s. Of these wells, 32 are located within the WVBA Site. The RID wells located within the WVBA Site are variably screened in the UAU, MAU and LAU. On average, RID pumps over approximately 75,000 AFY of groundwater from wells located in the WVBA Site. Based on the reported hydrogeologic conditions in the WVBA Site in the draft RI report, the RID wells probably derive most of their water from the UAU. While groundwater levels declined approximately 35 feet in the last 16 years, coinciding with onset of drought conditions in the mid-1990s, significant mining of groundwater resources has not occurred in the WVBA Site as a result of long-term sustained RID pumping. Other potential and current groundwater users in or near the WVBA Site include Salt River Project, COP, and the City of Tolleson (Terranext, 2007).

NATURE AND EXTENT OF CONTAMINATION

Groundwater contamination in the WVBA Site was first discovered in 1984 during routine groundwater sampling at the Phoenix Fuel Terminal (Terranext, 2008a). Since that time, a substantial effort has been undertaken to characterize the nature and extent of groundwater contamination, as well as identify potential contamination sources. Based on the RI and other supplemental characterization work, the primary contaminants of concern (COC) detected at concentrations above regulatory standards in the groundwater within the WVBA Site are VOCs. Specifically, the primary VOCs detected are tetrachloroethene

(PCE), trichloroethene (TCE), and 1,1-dichloroethene[11]. To a lesser extent, chromium is also considered a COCs. Methyl tertiary butyl ether (MTBE) has also been detected in the WVBA Site groundwater in the vicinity of the Phoenix Fuel Terminal (Terranext, 2008b). Limited recent data exist to determine the presence of other regulated compounds in the groundwater in the WVBA Site. Additional groundwater sampling may be performed to further characterize the water quality in the WVBA Site.

The draft RI report includes a detailed narrative, tabular, and graphical summary of the areal extent and temporal changes in COCs concentrations in the UAU1, UAU2, and MAU over the period 1993 to 2008. PCE and TCE concentrations as high as 95,000 micrograms per liter (μg/L) and 1,800 μg/L, respectively, have been reported in the UAU1 (Terranext, 2008a). The LAU does not appear to be impacted in the WVBA Site (Terranext, 2008a). In general over this time period, observed changes in COC concentrations in groundwater were attributed by Terranext to be the result of localized soil and groundwater remediation efforts at selected facilities in the WVBA Site and declining groundwater levels.

A brief summary of the extent of impacted groundwater in the UAU1, UAU2, and MAU is included below based on 1st quarter 2008 water quality data, as reported in the draft RI report. The following was concluded about the extent of impacted groundwater in the WVBA Site based on the 1st quarter 2008 water quality data included in the draft RI report:

UAU1

- The largest extent of detectable COCs in groundwater exists in the UAU1 **(Figure 4)**.
- The area of impacted groundwater generally exists between 7th Avenue on the east, Van Buren Street on the north, 71st Avenue on the west, and between

[11] Other hazardous substances detected in groundwater in the WVBA Site, WCP Site, and Motorola 52nd Street Site include benzene, toluene, ethylbenzene, xylenes, nitrate, vinyl chloride, 1,1,1-trichloroethane, cis-1,2-dichloroethene, 1,1-dichloroethane, and chloroform

Buckeye Road and the RID Main Canal on the south. One notable exception to this boundary exists in the north central portion of the WVBA Site, where impacted groundwater appears to be migrating into the site from the north, likely from the WCP WQARF Site (Terranext, 2008a).

- The highest reported concentrations of PCE and TCE in UAU1 groundwater based on monitor well data were 170 and 150 µg/L, respectively. All other COCs detected were at lower concentrations.
- Impacted RID wells are screened in UAU1.
- The spatially varying COC concentrations within the plume are consistent with the assertions presented in the draft RI report that numerous source areas throughout the WVBA Site have contributed to the plume.
- Elevated COC concentrations exist in the eastern portion of the WVBA Site near 7th Avenue and in the north central portion of the WVBA Site between 35th and 51st Avenues. These observations indicate that impacted groundwater has and likely continues to migrate from the 52nd Street and WCP Sites to the WVBA Site.

UAU2

- Impacted groundwater in the UAU2 exists in two distinct areas **(Figure 5)**. In the eastern and central portions of the WVBA Site, impacted groundwater generally exists between 7th Avenue on the east, Van Buren Street on the north, 51st Avenue on the west, and the RID main canal and the extension of Interstate 17 freeway on the south. In the western portion of the WVBA Site, an area of impacted groundwater at concentrations above regulatory standards exists between 59th Avenue on the east, the Interstate 10 freeway on the north, 75th Avenue on the west, and Buckeye Road on the south.

- The highest reported concentrations of PCE and TCE in UAU2 groundwater based on monitor well data were 39 and 160 μg/L, respectively. All other COCs detected were at lower concentrations.
- Impacted RID wells are screened in UAU2.
- Similar to UAU1, elevated COC concentrations exist in the eastern portion of the WVBA Site near 7th Avenue. This observation indicates that impacted groundwater has and likely continues to migrate from the 52nd Street Site to the WVBA Site.

MAU

- Significantly lower concentrations and a smaller extent of COCs in groundwater exist in the MAU compared to the UAU1 and UAU2 **(Figure 6)**. COC concentrations above regulatory standards were only reported for monitor well AVB82-01, located near the intersection of 67th Avenue and Van Buren Street.

LAU

- The LAU does not appear to be impacted by groundwater contamination in the WVBA Site, although limited investigations have been conducted in the LAU.

SOURCES OF CONTAMINATION

A substantial effort was undertaken by ADEQ during the RI to identify PRPs that have contributed to the groundwater contamination within the WVBA Site (Terranext, 2008a). Similar efforts to identify PRPs were conducted by EPA and ADEQ in the 52nd Street Site and ADEQ in the WCP Site. Over 60 PRPs have been identified in the WVBA

Site. Vadose zone investigations were conducted at approximately 49 of these facilities; groundwater investigations were conducted at 11 of these facilities (Terranext, 2008a).

Vadose zone and groundwater investigations were conducted in the late 1980s at the Phoenix Fuel Terminal (PFT) (originally designated the Van Buren Tank Farm) located south of Van Buren Street between 51st and 55th Avenues (Terranext, 2008a). The WVBA Site was originally designated as the Van Buren Tank Farm WQARF Site. Benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected in soil and groundwater beneath the PFT (Terranext, 2008a). BTEX were originally designated as COCs for the Van Buren Tank Farm Site; however, because BTEX contamination was regulated under ADEQ's Underground Storage Tank (UST) Program, they were removed as COCs when authority for BTEX sites in West Van Buren area was assumed by the UST Program in the late 1980s. The same halogenated VOCs as the WVBA Site COCs were detected in soil and groundwater beneath the PFT (Terranext, 2008a and ADEQ, 1989 and 1990). In addition, MTBE has been detected in the WVBA Site groundwater (and in RID production wells) in the vicinity of the PFT (Terranext, 2008b). The preliminary review of data for the PFT completed to date indicates that the facility could be a past or continuing source of COCs to the groundwater in the WVBA Site.

Over 25 PRPs have been identified in the 52nd Street Site, where releases and threatened releases of hazardous substances have been documented or are suspected to have impacted groundwater in the 52nd Street Site and the WVBA Site (Terranext, 2008a, ADEQ, 2008a). As previously discussed, water quality data from the WVBA Site indicate that COCs are migrating from the 52nd Street Site into the WVBA Site (Terranext, 2008a). The PRP search within the 52nd Street Site has not been completed and, therefore, additional PRPs may be identified in the future.

Over 20 PRPs have been identified in the WCP Site, where releases and threatened releases of hazardous substances have been documented or are suspected to have impacted

groundwater in WCP Site and the WVBA Site (Terranext, 2008a, ADEQ, 2008c). Migration of VOCs into the WVBA Site from the WCP Site in the area between 35th and 51st Avenues is indicated based on the available water quality data, and is suspected by ADEQ to be occurring. The WCP Site is subdivided into 5 distinct areas of impacted groundwater. The West Osborn Complex (WOC) Site is the largest and southernmost site in the WCP Site, and impacted groundwater associated with the WOC exists immediately north of the WVBA Site. The PRP search within the WCP Site has not been completed and, therefore, additional PRPs may be identified in the future.

IMPACT OF GROUNDWATER CONTAMINATION ON ROOSEVELT IRRIGATION DISTRICT OPERATION

RID operates approximately 50 production wells east of the Agua Fria River near or within the WVBA Site. These wells are screened in some or all of the UAU1, UAU2, MAU and LAU. Thirty-two (31 operational; RID-111 is currently inoperable) RID production wells are located within the WVBA Site **(Figure 7)**. Of these wells, 22 RID wells were documented to be impacted by COCs in 2006 (Terranext, 2008a). In September 2008, 18 RID wells had detectable concentrations of COCs and 14 RID wells were impacted by COCs at concentrations exceeding Arizona Aquifer Water Quality Standards (AWQSs) (Terranext, 2008b). The COCs detected above AWQSs in September 2008 include PCE, TCE, and 1,1-DCE. Of these COCs, PCE and TCE were the most prevalent and TCE was detected at the highest concentration of 85 µg/L in RID wells 92 and 114. The AWQS for both PCE and TCE is 5 µg/L. RID wells 107 and 108 also contained MTBE in 2006 at concentrations of 93 and 180 µg/L, respectively, and in 2008 at concentrations of 20 and 45 µg/L, respectively (Terranext, 2008a, b). These two RID wells are located near the PFT. An AWQS has not been established for MTBE. Groundwater pumped from RID wells 102 and 105 also contained total chromium in 2008 at concentrations of 21 and 12 µg/L, respectively. These concentrations are less than the AWQS for total chromium of 100 µg/L.

Currently, approximately 37,000 AFY of RID's seasonal groundwater withdrawal from the WVBA Site is impacted by the groundwater contamination. RID has approximately 71,000 AFY of annual pumping capacity in the currently impacted RID wells within the WVBA Site. The impacted groundwater pumped from the RID wells, along with wastewater and groundwater pumped from unimpacted RID wells, is currently conveyed to the RID Main Canal and then to RID's service area west of the Agua Fria River. Groundwater pumping from the RID wells comprises the primary groundwater discharge from the WVBA Site (Terranext, 2008a). Historical operation of RID wells appears to have limited the extent of COC-impacted groundwater within the WVBA Site.

The COC-impacted groundwater in the WVBA Site impairs RID's wells, its operation, and unrestricted use of its water supply, and represents an ongoing liability to RID, as previously stated in RID's comment letter on the draft RI report submitted to ADEQ on December 23, 2008 (RID, 2008). A comprehensive groundwater response action conducted under state and federal authority in the WVBA Site is required to mitigate the impairment and eliminate the associated liability to RID.

SUMMARY OF SITE STATUS

A substantial effort was undertaken by ADEQ and other parties to characterize the hydrogeologic conditions, nature and extent of impacted groundwater, and potential sources of contaminants to the groundwater in the WVBA Site over the past 20 years. Based on that effort, the following are key findings and milestones for the WVBA Site:

- The draft RI report was published by ADEQ in October 2008. The draft RI report summarizes the regional groundwater and contaminant assessment conducted by ADEQ and other private parties at facilities throughout the site.

- The Land and Water Use study has been completed. This study identified RID as the largest current groundwater user in the WVBA Site. This study also serves as one of the primary bases for development of the ROs.
- Impacted groundwater exists over a large area and to depths over 300 feet bls. Limited data exist in the LAU; however, the LAU is not suspected to be impacted based on the results of the RI.
- Numerous PRPs that have contributed or are threatening to contribute to the groundwater contamination have been identified in the WVBA Site, as well as the 52nd Street and WCP Sites. The available data indicate multiple sources of contamination including potential areas of dense non-aqueous phase liquids that could represent long-term recalcitrant sources of groundwater contamination. In some cases, remedial actions have been conducted or are ongoing at these sites to remove known sources of contamination in the soil.
- The community has been routinely informed on the project status and has actively participated in the administrative process.
- RID operates 32 production wells in the WVBA Site and as many as 22 of these wells have been impacted by the groundwater contamination. Pumping from these wells is the primary groundwater discharge from the WVBA Site.
- The pumping of impacted groundwater by RID constitutes the primary driver for the pending groundwater remedy in the WVBA Site based on the Land and Water Use study.
- The existing RID wells, conveyances, and easements are well-positioned to become the basis for an effective and economical regional groundwater remedy for the WVBA Site, and probably the 52nd Street Site and the WCP Site.

The next steps in the remedy selection process for the WVBA Site are to establish the ROs (with community input), publish the RO report, and publish the final RI report. Current budget constraints at the State will likely delay progress by ADEQ on these activities. However, based on a review of the draft RI report and Land and Water Use Report, sufficient

understanding of site conditions in the WVBA Site exists now to identify preliminary ROs and conduct a preliminary evaluation of remedial alternatives. Furthermore, the natural synergy between the primary driver for the WVBA groundwater remedy, **the impairment to RID**, and key infrastructure for the final groundwater remedy, **the RID wells, conveyances, and easements,** provides unique opportunities to streamline the remedy selection process, accelerate remedy implementation, and ultimately reduce the time required to mitigate impacts to RID wells and water uses and restore groundwater quality in the WVBA Site. Therefore, in light of potential delays in the project and in order to advance the remedy selection process and mitigate the adverse impact of the groundwater contamination on RID's wells and operations, this document proposes preliminary ROs and proposes and evaluates a reference remedy that is believed to be a logical, efficient, and economical solution to the widespread groundwater contamination in the WVBA Site.

PRELIMINARY REMEDIAL OBJECTIVES

Provision I of A.A.C. R18-16-406 outlines the process for formally establishing the ROs, which includes soliciting input from the community, preparing a draft RO report, soliciting and responding to public comments on the draft RO report, and publishing the final RO report. Information developed in the Land and Water Use study is important for establishing the ROs. After the ROs are established and the community involvement aspects of the RI process are complete, the final RI report will be published.

Remedial objectives are established to protect human health and the environment by eliminating, reducing, or controlling potential risk posed by each contaminant exposure pathway at a site. Additionally, the A.A.C. specifies that ROs must be developed in consideration of the current and reasonably foreseeable beneficial uses of waters of the state. Section 2.2.2.1 of the draft RI report for the WVBA Site summarizes the current and reasonably foreseeable water uses for production wells located in the WVBA Site based on the Land and Water Use study (Terranext, 2007). These beneficial uses include domestic, industrial, irrigation, utility, commercial, stock, testing and municipal. As indicated in the Land and Water Use study, RID is the largest groundwater user in the WVBA Site, and currently pumps groundwater primarily for agricultural irrigation uses. However, future use of water pumped by RID from the WVBA Site would include potable uses if appropriate treatment were conducted.

The A.A.C. also requires that ROs be generally consistent with the water use plans of all water users and providers whose water supplies are or may be impaired by the contamination. Therefore, at a minimum, the ROs for the WVBA Site must be consistent with RID's current agricultural end use, as well as its planned future potable drinking water end use. Considering that a drinking water end use is the highest beneficial use and carries with it the most stringent water quality standards, the preliminary ROs developed for the

WVBA Site are expected to protect all other current and future water users in the WVBA Site for any beneficial use. Achieving the ROs for a drinking water end use will also achieve protection against the loss or impairment of, and provide for the restoration of, the remaining uses of RID's water supply.

Based on information presented in the draft RI report, the results of the Land and Water Use study, and the criteria specified in provision I of A.A.C. R18-16-407, the following preliminary ROs are proposed by RID for the WVBA Site:

1. Protect human health and the environment by reducing and eventually eliminating potential exposure to COCs in the groundwater;
2. Restore groundwater to meet all beneficial uses including potable supply;
3. Prevent further degradation of groundwater quality by COCs;
4. Minimize the relocation, transfer, and/or volatilization of COCs from groundwater to the environment;
5. Prevent impacts to RID wells that are currently not impacted;
6. Maintain plume containment by continuing to operate the RID wells;
7. Provide all water users, with particular emphasis on RID, a water source that meets the maximum anticipated beneficial use as drinking water;
8. Maximize the beneficial use of the treated groundwater to support the goals and objectives of the Arizona Groundwater Management Act; and,
9. Provide long-term management of contaminated groundwater to improve the regional aquifer's suitability for potable use.

These ROs were developed based on the following considerations:

- The need to restore the groundwater quality by decreasing COC concentrations to less than AWQSs to support the use of this water for the maximum beneficial use as a source of drinking water;

- RID water supply wells have been impacted by the contamination;
- Containment and capture of contaminated groundwater at the Site is necessary to prevent plume movement and to protect down-gradient supply wells;
- ADEQ and EPA requirements to limit the transfer of VOCs from contaminated groundwater to air; and,
- The necessity for effective management of groundwater resources in the State of Arizona.

The timeframe when action is needed to mitigate the impairment to impacted RID wells and prevent impact to RID wells threatened by the contamination is immediate because RID relies on these wells for its water supply. The projected duration of the action needed to remediate these impacted waters for drinking water use is unknown; however, according to State law that protects all groundwater as a drinking water resource, the action must be continued until AWQSs for the COCs are achieved and consistently maintained.

The preliminary ROs will be refined based on input from the community and other stakeholders during completion of the final RI report and before the FS is conducted.

PRELIMINARY DEVELOPMENT AND ANALYSIS OF REFERENCE REMEDY

Formal development and detailed and comparative analysis of remedial alternatives will be conducted for the WVBA Site during the FS. The FS will be prepared based on an ADEQ-approved FS Work Plan. The requirements for development and analysis of remedial alternatives for groundwater remedies under the WQARF program are specified in provisions E through J of A.A.C. R18-16-407. The remedial alternatives selected for the WVBA Site will include remedial strategies and remedial measures that are sufficient to achieve all of the ROs and the goals specified for remedial actions in provision A of A.R.S. 49.282.06, which include:

1. Assure the protection of public health and welfare and the environment.
2. To the extent practicable, provide for the control, management or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state.
3. Be reasonable, necessary, cost-effective and technically feasible

The development and analysis of remedial alternatives for the WVBA Site will also be conducted in a manner consistent with the requirements and goals of the federal National Contingency Plan (NCP) and Superfund program.

As demonstrated in the preceding section of the Implementation Plan, site conditions, current and future water uses, and community expectations are sufficiently well understood to develop preliminary ROs. **These ROs, coupled with the unique synergy between the impetus and framework for the groundwater remedy associated with RID, make it feasible and practical to conceptually develop the reference remedy for the WVBA Site at this time.** During the FS, at least two additional remedial alternatives will be developed that would achieve the ROs and goals of the Arizona statute. These alternatives and the

reference remedy will be analyzed directly and comparatively against criteria specified in provisions G through J of A.A.C. R18-16-407 and, to the extent required, the nine criteria specified for FSs conducted under the federal Superfund program.

PROPOSED REFERENCE REMEDY

The reference remedy, designated as the RID GRA, was developed for the WVBA Site based on the following information: 1) provisions E1 and E2 of A.A.C. R18-16-407, 2) the goals of the NCP, 3) a detailed evaluation of the RI results, 4) a review of recent data and information on treatment technologies, and 5) the breadth of hydrogeologic and engineering experience of the RID technical team on similar groundwater contamination sites. **Figure 8** summarizes the range of potential remedial strategies, measures, and technologies considered during the development of the RID GRA. Alternative remedies that rely solely on "no action" or "monitoring" strategies, as well as remedies that rely on institutional controls as a primary remedial measure, would not achieve all of the ROs and, therefore, were not considered in this evaluation. These remedial strategies and measures may be useful secondary components of any alternative and, therefore, may be evaluated further in the FS.

The proposed RID GRA uses the "pump and treat" approach, which has been established by the EPA as a presumptive remedy for groundwater contamination sites based on decades of use (EPA, 1996). Based on a preliminary analysis of available water quality data and the requirements for achieving the proposed ROs, treatment by liquid-phase granular activated carbon (GAC) and air stripping for organic COCs are considered to be the most appropriate treatment technologies to remove COCs from the groundwater, which are primarily VOCs. Liquid-phase GAC would be used to treat impacted water that could be used for potable supply because it meets ADEQ and EPA requirements for fail-safe secondary treatment safeguards to ensure complete COC removal. Air stripping treatment may be used to treat impacted water that would be used for irrigation or industrial supply.

As previously discussed, MTBE and chromium are also present in the groundwater within the WVBA Site and selected RID wells. These compounds are not readily treated using liquid-phase GAC; therefore, groundwater potentially pumped from RID wells containing MTBE and/or chromium above applicable standards or acceptable end use concentrations may require additional evaluation, management and/or treatment.

As demonstrated above, the WVBA Site requires a comprehensive assemblage of ROs to address the extensive groundwater contamination and its ongoing adverse impact on RID's current and future operations. An equally comprehensive groundwater response action is required to meet these ROs. **As previously indicated, when combined with appropriate treatment, the existing RID wells and conveyances are ideally positioned for use in an effective, economical, and comprehensive groundwater response action.**

The proposed RID GRA is depicted on **Figure 9** and summarized in **Table 2.** The RID GRA would be implemented in 2 phases. Performance data from early phases would be used to determine the need for and scope of subsequent phases. The conceptual phasing of the RID GRA is as follows:

Phase 1 (Early Response Action) – Phase 1 would be completed as an ERA. The rationale for completing Phase 1 as an ERA is discussed in detail later in this Plan. Phase 1 would treat up to approximately 20,000 gpm of impacted groundwater **(Table 2; Figure 9)**. Phase 1 would be completed in two sub-phases: Phase 1A and Phase 1B.

Phase 1A

The objective of Phase 1A is to begin groundwater treatment in an efficient, economical and effective manner as soon as possible. To meet this objective, Phase 1A would include design and construction of the new 20,000 gpm liquid-phase GAC treatment facility to be located at the RID Operations Facility near 84th Avenue and Van Buren

Street. Phase 1A would treat impacted groundwater from RID wells 105, 106, 107, 108, 109, 110, 112, 113, and 114 located along Van Buren Street and adjacent to the existing RID Salt Canal (**Figure 9**). These wells would be operated as continuously as possible depending on the demand for treated water (instead of the current seasonal operation) to maximize capture and contaminant mass removal. The impacted groundwater would be conveyed to the new treatment facility in the existing Salt Canal (with minor improvements to eliminate open sections) and a new below-grade pipeline installed from the terminus of the Salt Canal near 83rd Avenue to the new treatment facility. The treated water from Phase 1A would be used for its highest beneficial use, which could include irrigation, industrial supply, and/or potable supply. A Poor Quality Groundwater Withdrawal Permit may be obtained during Phase 1A in coordination with the Arizona Department of Water Resources.

Based on current VOC concentrations in the Phase 1A RID wells, the estimated total annual VOC mass removal during Phase 1A would be approximately 3,720 pounds (**Table 2**). Groundwater and treatment facility performance monitoring would be conducted during Phase 1A to obtain data to assess wellfield capture and treatment effectiveness.

RID wells 107 and 108 have been included in Phase 1A for conceptual planning purposes. Historical and recent water quality data from these wells indicate substantial concentrations of MTBE in addition to other COCs. MTBE has been used as a gasoline additive since the late 1970s. The probable source of MTBE to the groundwater in the vicinity of RID wells 107 and 108 is the PFT, which is located immediately east and upgradient of these wells. If incorporated into Phase 1A, these wells may require an additional or different treatment technology than liquid-phase GAC to remove the MTBE because MTBE is not readily removed using liquid-phase GAC (EPA, 1998). Phase 1A may include treatability studies to determine the best treatment technology for

groundwater pumped from RID wells 107 and 108, or to determine whether blending and restricted use of these wells can minimize MTBE concentrations in the treated water.

Phase 1B

The objectives of Phase 1B would be to expand wellfield capture and maximize COC mass removal by treating impacted groundwater from the RID wells that have the highest total COC concentrations. The planning, design, permitting, and property access elements of Phase 1B would begin concurrently with the initiation of Phase 1A and proceed on a parallel track. It is envisioned that these Phase 1B elements will take up to 1 year to complete. Therefore, it is envisioned that Phase 1B would begin approximately 1 year after the initiation of Phase 1A.

To meet these objectives, RID wells 89, 92, 95, and 100 would be incorporated into the operation and pumped on a continuous basis (**Table 2; Figure 9**). This would be accomplished by installing new below-grade pipelines from these wells to the Salt Canal. To maintain the total treated flow rate in the Salt Canal at approximately 20,000 gpm, extracted groundwater from RID wells 105, 109, and 110 would be conveyed to the RID main canal in additional new below-grade pipelines and the existing RID pipelines between RID wells 89, 92, and 95 and the RID Main Canal. After redirecting the extracted groundwater from these RID wells, they would be operated on a seasonal demand basis. However, if additional capture near the leading edge of the plume is required, RID well 95 would be pumped as continuously as possible to maximize capture.

The Phase 1B wellfield is expected to be effective at controlling the migration of the western plume leading edge, extracting groundwater with high COC concentrations from the central portion of the plume, and minimizing the southerly migration of the impacted water towards the unimpacted RID wells located along the RID Main Canal. Based on

current VOC concentrations in the Phase 1B RID wells, the estimated total annual VOC mass removal during Phase 1B would be approximately 5,700 pounds (**Table 2**). The treated water from Phase 1B would be used for its highest beneficial use, which could include irrigation, industrial supply, and/or potable supply.

Phase 2 (Supplemental Response Action) – The objective of Phase 2 would be to develop appropriate remedial measures that provide RID unrestricted use of its water supply. This objective would require sufficient reduction in the VOC concentrations in groundwater pumped from the remaining impacted RID wells to maintain VOC concentrations below AWQSs in the RID Main Canal at appropriate points of compliance. It is envisioned that this objective could be accomplished through a combination of priority pumping, blending, and treatment. Based on the current understanding of site conditions and RID operations, Phase 2 would include the following activities: 1) construction and operation of either well head or local low profile air strippers to treat impacted groundwater from RID wells 84, 99, 102, and 104 (**Figure 9**); 2) modifications to discharge structures at RID wells 88 and 91 to blend clean water from these wells with impacted groundwater from RID wells 109 and 110 before discharge to the RID Main Canal; and 3) monitoring water quality at appropriate points of compliance in the RID Main Canal to ensure that VOCs are below AWQSs.

Reactivation of RID well 111 will also be evaluated as part of Phase 2. RID well 111 is currently inoperable and based on the current understanding of site conditions, the well will not be needed to enhance plume remediation. The well may be redrilled at a location outside the plume with approval from ADEQ and Arizona Department of Water Resources.

The phased RID GRA is believed to be an efficient, effective, and economical remedy because it would: 1) comply with the remedial action requirements specified in A.R.S. 49-282-06 and NCP, 2) achieve all ROs, 3) take full advantage of existing RID infrastructure, 4) use presumptive remedial technologies that are proven, 5) provide an effective regional groundwater remedy that benefits stakeholders in the WVBA, 52nd Street,

and WCP Sites, and 6) provide a secure source of remediated water that could be used for potable supply with post-remedy treatment.

In addition to the phased implementation of the RID GRA, an option to incorporate additional groundwater extraction in OU3 to minimize VOC mass migration into the WVBA Site will be evaluated. Additional discussions with ADEQ, EPA, and 52nd Street PRPs are required to further assess the viability of this option, and to identify options for conveying and treating the impacted groundwater, and discharging it for beneficial use.

PRELIMINARY ANALYSIS OF THE REFERENCE REMEDY

A preliminary analysis of the RID GRA (reference remedy) was conducted using the criteria specified in A.A.C. R18-16-407 for FSs.

Achievement of Remedial Objectives

The RID GRA would conceptually achieve all of the ROs, which is a fundamental requirement of A.A.C. R-18-16-407. Specifically, it would protect human health and the environment because potential exposure pathways would be eliminated and the COC concentrations, mass, volume, toxicity, and mobility would be reduced through extraction and treatment. Assuming that source control measures within the WVBA Site have been and will continue to be effective and the VOC mass contribution from OU3 is eliminated, the RID GRA would be expected to reduce COC concentrations to less than AWQSs over time[12]. It would also maintain hydraulic control of the plume and prevent further impact to

[12] Any objective analysis of aquifer restoration can only be conducted in relative terms. Moreover, at a site like the WVBA Site, with such pervasive and widespread groundwater contamination, the timeframe to restore groundwater cannot be estimated with a high degree of certainty. The groundwater restoration time is highly uncertain due to the likely presence of multiple continuing sources of groundwater contamination from undocumented COC releases and threatened releases to the subsurface, the potential presence of dense non-aqueous phase liquids in the soil and groundwater, and diffusion-limited COC migration from recalcitrant fine-grained sediments throughout the site. In practical terms, it is likely that all remedial actions will require a long and indeterminate time to achieve aquifer restoration, which may be on the order of 50 to 100 years or longer. Any reference to the relative time to restore groundwater quality may therefore have little practical implication in terms of current decision making.

clean RID wells because the proposed remedy pumping scheme would be similar to the historic operations, which are believed to have controlled plume expansion. The remediated water from the RID GRA would meet all beneficial uses, including use as a drinking water source, if additional treatment were performed.

Source control is implicitly incorporated in the RID GRA because it is required in provision F of A.A.C. R18-16-407. It was assumed that source control in the WVBA Site, WCP Site, and OU3 is either complete or would be conducted by the PRPs in the future under direction from ADEQ and/or EPA. The cost of source control would be the responsibility of the individual PRPs and is not included in **Table 1.**

Consistency with Land and Water Use Plans

The RID GRA is considered to be consistent with the current and foreseeable future land use plans within the WVBA Site. Because the RID GRA uses primarily existing infrastructure, its impact to land within the WVBA Site is expected to be minimal. The RID GRA would likely require some new easements and property access agreements from public and private entities, which are believed to be obtainable under the current site conditions.

The RID GRA would be consistent with the current and foreseeable future water use plans of water users in and near the WVBA Site because it is a comprehensive plan to restore the groundwater quality for all beneficial uses and prevent further impact to groundwater and wells.

The RID GRA would eventually restore groundwater quality for all beneficial uses, which would provide a usable supply of groundwater for all potential water users in the WVBA Site. The rate and duration of groundwater extraction proposed for the RID GRA is not expected to adversely deplete regional groundwater resources because the proposed

remedy pumping rates are similar to historical RID pumping rates, which have not caused significant groundwater mining in the WVBA Site.

Preliminary Analysis of Comparison Criteria

Provision H3 of A.A.C. R18-16-407 requires a comparative analysis of remedial alternatives using the following criteria: 1) Practicability, 2) Risk, 3) Benefit, and 4) Cost. A comparative analysis will be conducted during the FS between the RID GRA and at least two other remedial alternatives. A direct analysis of the RID GRA using these 4 criteria was conducted for the Implementation Plan.

Practicability

The RID GRA is considered highly practicable because it uses effective, reliable, and presumptive technologies that can likely be designed, permitted, constructed, and operated in the WVBA Site. The RID GRA uses existing RID infrastructure to the greatest extent practicable and would require only limited new easements or property access agreements; therefore, it is expected that it can be implemented in a relatively short timeframe compared to other potential remedial alternatives that require significant new construction of pipelines and wells.

Risk

The RID GRA is expected to:

- Protect human health and environment, both during and after the remedy, through the reduction of concentration, volume, mass, toxicity, and mobility of COCs over time by nominally continuous groundwater extraction and treatment;

- Have minimal risk associated with the end uses of the treated water because an effective treatment technology would be used. The selected treatment technology would be approved and permitted by ADEQ. As previously discussed, liquid-phase GAC is assumed to be the most appropriate treatment technology based on a preliminary evaluation of available water quality data; and

- Have minimal residual risk in the aquifer after remediation is complete.

Benefit

The RID GRA would benefit the WVBA Site stakeholders in a variety of ways including:

- Reducing the risk to the public and environment through elimination of potential exposure pathways to COCs in groundwater;
- Reducing the mass of COCs in groundwater pumped from the WVBA Site and used by RID through treatment;
- Reducing the liability to water providers, particularly RID, by improving groundwater quality;
- Restoring all beneficial uses of the WVBA Site groundwater;
- Generating a secure source of remediated water that can be used for a variety of beneficial uses include potable supply; and
- Generating economic benefits due to the favorable availability of the remediated water in accordance with A.A.C. R18-16-407(H)(3)(d)(vi).

Cost

A range of estimated costs for the RID GRA was developed using unit pricing data from vendors, engineering estimates, and cost data from comparable recent projects. These estimates were based on assumptions that are believed to be reasonable and consistent with

the degree of accuracy typically achieved during a feasibility study. The estimates included capital costs and long-term operation and maintenance (O&M) costs.

Lump sum capital costs were estimated for the proposed RID GRA that included a 10 percent contingency. The proposed Phase 1 activities that comprise the ERA are reasonably well understood at this time; therefore, the capital costs can be forecasted with a reasonable degree of certainty. However, the scope of the supplemental response actions is less certain at this time and will be further developed during the pending FS analysis, hence, the range of costs. Annual O&M costs were estimated for year one of the remedy lifetime as well as on a net present value basis. The NPV analysis assists in evaluation of expenditures that occur at different times and over extended timeframes. The NPV estimates for O&M are based on a 30-year project duration, using a 6 percent discount factor, a 3 percent inflation escalation rate, and a 20 percent contingency.

The estimated range of costs in millions of dollars ($MM) for implementing the proposed RID GRA is as follows:

	PHASE 1 (EARLY RESPONSE ACTION)	PHASE 2 RESPONSE ACTIONS	TOTAL RESPONSE ACTION COSTS
Capital Cost ($MM)	$34	$4.7 to $13.2	$38.7 to $47.2
Annual O&M Cost ($MM)	$4 to $5	$0.4 to $1.5	$4.4 to $6.5
30-Year NPV for O&M Costs (@ 6% discount) ($MM)	$77 to $96	$8 to $29	$85 to $125
Capital and 30-Year NPV O&M Costs (@ 6% discount) ($MM)	$111 to $130	$12.7 to $42.2	$123.7 to $172.2

The proposed RID GRA is believed to be the **preferred remedy** for the WVBA Site because it would:

- Provide a unique balance between practicability, benefit, risk reduction, and cost;
- Comply with the remedial action requirements of A.R.S. 49-282.06;
- Achieve all preliminary ROs;
- Result in a comprehensive, efficient, effective, and economical remedy that takes advantage of existing infrastructure to minimize the impact to land use in the WVBA Site;
- Protect the public from potential exposure to COCs in groundwater through treatment and monitoring:
- Ultimately restore the groundwater quality in the WVBA Site to AWQSs;
- Provide long-term, sustainable groundwater pumping for plume containment and mass removal while enabling use of the currently impacted groundwater for any beneficial use, including use for drinking water supply; and
- Be consistent with all current and potential future water users in the WVBA Site.

A comprehensive analysis of the RID GRA compared to other remedial alternatives will be conducted in the feasibility study; however, it is expected that the RID GRA Response Action will be identified as the preferred remedy based on that analysis.

IMPLEMENTATION PLAN

The preliminary development of ROs and the development and analysis of the RID GRA have demonstrated the following:

- There is an immediate need to begin groundwater restoration in the WVBA Site to mitigate the widespread contamination and adverse impact to RID;
- The existing RID wells and conveyances provide an efficient and economical means to begin a phased and comprehensive groundwater response action; and
- The RID GRA would meet all ROs, restore groundwater to meet all beneficial uses, and provide a significant near- and long-term source of remediated water that could be used for variety of beneficial uses including potable supply.

A comprehensive plan has been developed by RID that will expedite the implementation of a groundwater response action in the WVBA Site that takes advantage of the unique and favorable remedy implementation conditions in the WVBA Site. The fundamental components of this plan are: 1) an ERA and 2) a rapid, streamlined, and parallel track approach to fulfill the requirements of the A.A.C. and the NCP for selection of the final groundwater remedy.

EARLY RESPONSE ACTION

RID proposes to begin an ERA immediately to begin mitigation of the widespread groundwater contamination and to protect RID wells that have yet to be impacted by the groundwater contamination. The goals and requirements for an ERA are specified in A.A.C. R18-16-405. The initial steps in an ERA are the **written rationale** and the **Work Plan**. The rationale for the ERA and an overview of the ERA Work Plan are presented below; the complete ERA Work Plan has been prepared under separate cover.

Rationale for Early Response Action

In accordance with provision A of A.A.C. R18-16-405, the following goals were developed for the RID ERA:

- Begin treating impacted groundwater from a large portion of the WVBA Site to reduce the risk to the public and the environment and to prevent further groundwater degradation;
- Begin mitigating the adverse impact from the groundwater contamination on RID's operations and provide a clean supply of groundwater to RID for irrigation, industrial, and potable uses;
- Initiate a program of priority pumping on a nominally continuous basis at the most highly impacted RID wells to maintain plume control and reduce COC mass in groundwater to reduce the threat to unimpacted RID wells; and
- Begin restoring groundwater quality in the WVBA Site immediately to prevent further groundwater degradation.

The ERA comprises Phase 1 of the RID GRA and was developed based on an evaluation of site conditions reported in the draft RI report, the preliminary ROs, the results of the preliminary evaluation of remedial alternatives, extensive experience with similar groundwater contamination sites, and sound hydrogeologic and engineering principles. The ERA includes actions and technologies that are proven effective, reliable, and are considered presumptive based on decades of use in remediating groundwater contamination. Specifically, the RID ERA would include the following **(Figure 10)**:

- A phased implementation of nominally continuous groundwater extraction based on treated water demand from up to 10 existing impacted RID wells in the WVBA Site (Phase 1B wellfield).

- Conveyance of a nominal 20,000 gpm of impacted water in the existing RID Salt Canal and new below-grade pipelines. The existing short reaches of open Salt Canal would be replaced with new below-grade pipe.
- Treatment of a nominal 20,000 gpm of impacted water at a new liquid-phase GAC treatment facility located at the RID Operations Facility.
- Discharge of treated water to RID Main Canal for irrigation use or conveyance to the west valley via a new pipeline constructed in existing easements along the RID Main Canal. A Poor Quality Groundwater Withdrawal Permit may be obtained during the ERA in coordination with the Arizona Department of Water Resources.

The ERA was developed using the following specific information:

- The figures and tables included in the draft RI report that delineate the nature and extent of COCs in the groundwater in the WVBA Site based on over 20 years of investigation (Terranext, 2008a). The draft RI report clearly demonstrates that widespread groundwater contamination has persisted for a long period of time in the WVBA Site; COCs exist in groundwater at concentrations greater than AWQSs; and as many as 22 RID wells have been impacted by COCs.
- Groundwater extraction and treatment have been demonstrated at hundreds of contamination sites to be effective at hydraulically containing impacted groundwater to prevent further degradation, reducing COC mass in the groundwater, and in many cases, successfully reducing COC concentrations to levels that mitigate long-term risk and eliminate human exposure pathways associated with the contamination. Groundwater extraction and treatment are considered to be the presumptive remedy to address groundwater contamination (EPA, 1992 and 1996). Specifically, liquid-phase GAC is a presumptive fail-safe treatment technology for removing organic COCs from impacted groundwater used for potable water supply.

The ERA would achieve the goals specified above as follows:

Begin treating impacted groundwater from a large portion of the WVBA Site to reduce the risk to the public and the environment and to prevent further groundwater degradation.

The 10 existing impacted RID wells proposed for the ERA (i.e., the RID GRA Phase 1B wellfield) are well positioned to extract impacted groundwater from the downgradient portion and highest concentration areas of the plume. An extraction well network distributed along the plume axis, such as proposed for the ERA, has been demonstrated over many decades of experience, groundwater modeling, and remedial wellfield performance evaluations to be an efficient well alignment for plume containment and remediation (EPA, 1997). The proposed ERA wellfield is expected to be effective at controlling the migration of large portions of the plume, removing large volumes of high COC-concentration groundwater, and reducing the mass of COCs in groundwater.

Liquid-phase GAC is a presumptive technology for the removal of VOCs from groundwater because it has been widely demonstrated to be effective and reliable at numerous groundwater contamination sites over decades of use. Based on the current COC concentrations in the 10 RID wells proposed for use in the ERA (i.e., the RID GRA Phase 1B wellfield), the ERA would **remove approximately 5,700 pounds of VOCs annually from the plume during the early years of the remedy**. In comparison, the Motorola 52nd Street Superfund Site OU1 groundwater treatment facility removed approximately 19,300 pounds of contaminants during the first 16 years of operation between 1992 and 2008, or an average of approximately 1,200 pounds per year (ADEQ, 2008a). Similarly, the OU2 groundwater treatment facility removed approximately 10,600 pounds of contaminants during approximately 7 years of operation between December 2001 and September 2008, or an average of approximately 1,500 pounds per year (ADEQ, 2008a).

Plume containment and the reduction in COC concentrations in air and groundwater would reduce the potential risk to the public and environment.

Begin mitigating the adverse impact from the groundwater contamination on RID's operations and provide a clean supply of groundwater to RID for irrigation, industrial, and potable uses.

Removing the COCs from the groundwater through treatment would substantially mitigate the adverse impact to RID and its wells from the groundwater contamination, and ensure that RID can deliver clean groundwater to its west service area for irrigation, industrial, and/or potable use.

Initiate a program of priority pumping on a nominally continuous basis at the most highly impacted RID wells to maintain plume control and reduce COC mass in groundwater to reduce the threat to unimpacted RID wells.

The ERA will include pumping and treating contaminated groundwater from 10 of the most highly impacted RID wells as continuously as possible throughout the year depending on the demand for the treated water. This nominally continuous operation will provide a greater degree of plume containment compared to the current seasonal operation, and will provide greater protection of the unimpacted RID wells located within the WVBA Site. Under the ERA pumping scheme, the proposed nominally continuous pumping of the impacted wells would reduce the potential for southerly plume migration during the off peak season, which would result in greater plume control throughout the year.

Begin restoring groundwater quality in the WVBA Site immediately to prevent further groundwater degradation.

The RID ERA will include nominally continuous pumping (as opposed to the current seasonal pumping scheme) that will be largely effective at preventing further groundwater degradation. The proposed ERA comprises Phase 1 of the proposed RID GRA, which is believed to be the preferred final groundwater remedy for the WVBA Site. Therefore, the ERA is fully expected to remain as an integral component of the final groundwater remedy.

In addition to attaining the above-stated goals, the ERA is also consistent with the goals specified for remedial actions in provision A of A.R.S. 49.282.06, which states that a remedial action shall:

1. Assure the protection of public health and welfare and the environment.
2. To the extent practicable, provide for the control, management or cleanup of the hazardous substances in order to allow the maximum beneficial use of the waters of the state.
3. Be reasonable, necessary, cost-effective and technically feasible.

Overview of Early Response Action Work Plan

A Work Plan for the ERA has been prepared under separate cover. The tasks envisioned for the ERA include:

1. Meetings
2. Community Involvement (in accordance with A.A.C. R18-16-404, the NCP, and the existing WVBA Site Community Involvement Plan)
3. Data Collection and Analysis
4. Permits and Property Access
5. Design
    - Well Modifications and Well Head Improvements
    - Salt Canal Improvements

- Treatment System (including booster station and control system)
- Treated Water Distribution Pipeline

6. Construction
7. System Testing and Startup
8. Operation and Maintenance Plan

The ERA Work Plan also includes the rationale for the ERA, a brief summary of site conditions, and a proposed schedule. At this time, it is envisioned that evaluation, design, construction, and startup of the ERA will take approximately 2 years.

FINAL GROUNDWATER REMEDY

The final groundwater remedy for the WVBA Site will be appropriately evaluated and formally selected in accordance with the processes outlined in Article 4, Chapter 16 of A.A.C. R18 and the NCP (40 CFR, Chapter 1, §300.430). It is envisioned that this process can be expedited, streamlined, and completed concurrently with the ERA because of the favorable alignment of the existing RID wells and conveyances relative to the impacted groundwater in the WVBA Site and through the active participation of RID and its technical team with ADEQ, EPA, and the community. **Table 3** summarizes the tasks and estimated schedule envisioned to complete the final groundwater remedy for the WVBA Site.

TABLE 3. CONCEPTUAL FINAL GROUNDWATER REMEDY IMPLEMENTATION SCHEDULE

TASK NO.	TASK DESCRIPTION	LEAD PARTY	ESTIMATED COMPLETION DATE
1	RID Groundwater Response Action Implementation Plan	RID	September 2009
2	Early Response Action Work Plan	RID	September 2009
3	Feasibility Study Work Plan	RID	October 2009
4	Remedial Objectives Report	ADEQ/RID	November 2009
5	Final RI Report	ADEQ/RID	January 2010
6	Feasibility Study	RID	March 2010
7	Proposed Remedial Action Plan	RID	June 2010
8	Record of Decision	ADEQ	November 2010
9	Remedial Design	RID	May 2011
10	Remedial Action Construction	RID	December 2012
11	Remedial Action Startup	RID	January 2013

RID recognizes that this schedule is ambitious and envisions the following activities and commitments will be required to meet it:

- Execution of a working agreement between RID and ADEQ;
- A diligent effort from RID to understand the remedy selection process and efficiently prepare the necessary work plans and reports with input from ADEQ;
- RID assistance to ADEQ WQARF Program to develop and finalize ROs for the Site and to prepare final RI report;
- Timely review and approval of work plans and reports by ADEQ and other stakeholders;

- Frequent and effective communications with the community and other stakeholders to efficiently obtain productive input to the remedy selection process; and
- Timely consideration and response from ADEQ on community and stakeholder input and concerns.

RID also recognizes that the proposed groundwater response action represents an efficient, effective, and economical means to address the wide-spread groundwater contamination in the WVBA Site. The favorable disposition of the existing RID wells, conveyances, and easements should enable RID, ADEQ, the community, and other stakeholders to work productively and efficiently towards rapid implementation of an effective response action. In principle, the approach envisioned by RID for the WVBA Site is consistent with the ideals and objectives of the **EPA SACM** (EPA, 1992). The SACM was developed by the EPA as a framework to accelerate the clean up process at contaminated sites by taking advantage of presumptive remedies, implementing early response actions, phasing remedy implementation, and obtaining public input early and frequently.

SUMMARY

This Groundwater Response Action Implementation Plan was prepared on behalf of RID to achieve specific objectives. The following summary demonstrates how each of these objectives has been achieved.

Objective 1 – Summarize an abbreviated conceptual site model for the WVBA Site that demonstrates the need for a groundwater response action to mitigate the adverse impacts caused by the contamination and adverse impacts to RID wells, its operation, and its water uses.

The following findings of the RI demonstrate the need for the groundwater response action:

- Extensive groundwater contamination primarily by VOCs exists in the WVBA Site as depicted on **Figures 4 through 6**.
- Up to 22 RID production wells have been impacted by the groundwater contamination. These impacted wells have a pumping capacity of approximately 71,000 AFY.
- Numerous PRPs have been identified where subsurface investigations conducted at their facilities have indicated contributions of hazardous substances to the soil and the regional groundwater contamination. The PRPs are responsible for the regional response action costs.
- Water quality data from the WVBA Site indicate that impacted groundwater containing VOCs continues to migrate from 52nd Street and WCP Sites to the WVBA Site. Numerous PRPs have been identified in 52nd Street and WCP Sites where past and/or continuing contributions to the regional groundwater contamination are likely.

Objective 2 – Demonstrate that a groundwater response action that uses RID's wells, conveyances, and easements (designated as the "RID Groundwater Response Action") is the most logical, efficient, and economical reference remedy for the WVBA Site based on a

preliminary analysis conducted in accordance and consistent with A.A.C. R18-16-407 and 40 CFR, Chapter 1, §300.430 for feasibility studies.

The proposed RID GRA was developed for the WVBA Site to achieve the preliminary ROs, comply with remedial goals specified in Arizona statute, and to be consistent with the federal NCP. A preliminary analysis of the RID GRA was conducted using the criteria specified in Arizona Administrative Code **(Table 1)**. The preliminary analysis indicates that the RID GRA **(Table 2; Figure 9)**, designated as the reference remedy, is reasonable, economical, and technically feasible; achieves all of the preliminary ROs; achieves a unique balance between the comparison criteria specified in Title 18; and is consistent with the federal NCP. In particular, the RID GRA is highly practicable, effective at reducing risk to the public, provides a variety of benefits to the public and other WVBA Site stakeholders, and is economical because it uses existing RID infrastructure to the greatest degree possible.

Objective 3 – Demonstrate that the RID GRA fully complies with the remedial objectives specified in Arizona Revised Statute (A.R.S.) 49-282.06 and is consistent with the federal NCP as specified in 40 CFR, Chapter 1, §300.430, and, therefore, meets all of the requirements for selection as the preferred final remedy for the WVBA Site.

The preliminary ROs developed for the WVBA Site represent specific objectives that are relevant to the conditions within the site. By default, the preliminary ROs are consistent with the overall goals specified in the Arizona statute and federal NCP. The RID GRA would be expected to achieve all of the preliminary ROs; therefore, it would also achieve the remedy goals specified in Arizona statute and be consistent with the federal NCP.

Objective 4 – Propose a plan to expedite implementation of the RID GRA for the WVBA Site that includes an Early Response Action (ERA; A.A.C. R18-16-405). The proposed ERA would be completed immediately and in parallel with completion of the feasibility study (FS), proposed remedial action plan (PRAP), and record of decision (ROD) (collectively designated as the "administrative requirements") associated with the selection of the final groundwater remedy as defined in Article 4 (Remedy Selection) of A.A.C. R18-16 and the federal NCP as specified in 40 CFR, Chapter 1, §300.430. Given the apparent preferred status of the RID GRA, this plan proposes a streamlined approach to meet the administrative requirements for final remedy selection that focuses the required analysis,

reduces the level of agency effort on review and approvals, effectively incorporates input from the community, and facilitates earlier start up of the final groundwater remedy.

The scope and an overview of the Work Plan for the ERA were presented in the Implementation Plan. The Work Plan has been prepared under separate cover. Completing Phase 1 of the RID GRA as an ERA, which can begin immediately after approval from ADEQ and development of funding sources, is needed to prevent further degradation of groundwater, protect unimpacted RID wells, begin the regional groundwater restoration and, most importantly, begin to mitigate the adverse impact of the groundwater contamination on RID's wells, its operation, and the unrestricted use of its water supply. The ERA, which comprises a nominal 20,000 gpm pump and treat operation, is estimated to remove approximately 5,700 pounds of VOCs annually during the early years of operation. The estimated range of 30-year NPV cost of capital and O&M of the ERA is $111,000,000 to $130,000,000. It is envisioned that approval of the ERA from ADEQ would be obtained in 2009 and implementation would occur over the ensuing 12 to 18 months.

The administrative process (e.g., the FS, PRAP, and ROD) required to select the final groundwater remedy would be conducted concurrently with the ERA. It is envisioned that the effort required to complete the administrative process can be streamlined in light of the unique synergy that exists between the primary harmed party, RID, and the favorable disposition of its wells, conveyances, and easements as the foundation of an efficient and economical regional groundwater response action.

Objective 5 – Provide the rationale for the ERA in accordance with provision C of A.A.C. R18-16-405 and to be consistent with the goals of the SACM (EPA, 1992).

The rationale for the ERA was provided in this Implementation Plan. The fundamental tenant of the ERA is to begin the response action immediately to protect the public from exposure to COCs in groundwater, initiate groundwater quality restoration, and begin to mitigate the adverse impact to RID's wells, its operation, and the unrestricted use of its water supply. The proposed ERA comprises Phase 1 of the RID GRA and, by itself, represents a comprehensive groundwater response action that may achieve most, if not all, of

the ROs. If it fails to achieve all ROs, the subsequent phases of the response action will be evaluated and implemented to the degree necessary to achieve all ROs.

Objective 6 – Present an overview of the Work Plan for the ERA, which has been prepared under separate cover in accordance with provision D of A.A.C. R18-16-405 and will be submitted to the ADEQ in September 2009.

An overview of the ERA Work Plan was presented in the Implementation Plan. The Work Plan has been prepared under separate cover and is scheduled to be submitted to ADEQ in September 2009. The ERA Work Plan outlines the necessary data collection, data evaluation, design, and construction steps to fully implement the proposed ERA.

Objective 7 – Present an accelerated implementation schedule for the proposed RID GRA.

Table 3 includes a conceptual implementation schedule for the RID GRA that would culminate in startup of the full-scale response action by January 2013. The proposed schedule is ambitious; however, RID and its legal and technical team believe that the favorable disposition of the existing RID wells, conveyances, and easements should enable RID, ADEQ, the community, and other stakeholders to work productively and efficiently towards rapid implementation of the proposed response action.

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TABLE 1
PRELIMINARY ANALYSIS OF ROOSEVELT IRRIGATION DISTRICT GROUNDWATER RESPONSE ACTION

ROOSEVELT IRRIGATION DISTRICT
GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN WATER QUALITY ASSURANCE REVOLVING FUND SITE

REMEDIAL ALTERNATIVE	REMEDIAL STRATEGIES	REMEDIAL MEASURES	REMEDY COMPONENTS	REMEDIAL OBJECTIVE ACHIEVEMENT	CONSISTENCY WITH LAND AND WATER USE PLANS	COMPARISON CRITERIA			
						Practicability	Risk	Benefit	Estimated Cost
Reference Remedy: **Roosevelt Irrigation District (RID) Groundwater Response Action** **Phase 1 - Early Response Action** - nominal 20,000 gallon per minute (gpm) extraction and treatment system **Phase 2 - Supplemental Response Actions** - manage operation of remaining impacted RID wells to maintain contaminants of concern (COC) concentrations below AWQSs or other appropriate standards through treatment, blending, and/or priority pumping	Plume Remediation, Plume Containment, Source Control, and Monitoring *note: assumes source control in the West Van Buren Area (WVBA) Site is conducted by potentially responsible parties (PRPs) and sources upgradient of the WVBA Site are addressed under Federal Superfund Program by the Environmental Protection Agency (EPA).*	Groundwater extraction; impacted water conveyance; central, local, and/or wellhead treatment; treated water discharge for all beneficial uses; sampling, lab analysis, and reporting	Treat impacted groundwater from up to 16 existing RID production wells; wellhead improvements; use approximately 8 miles of existing RID pipelines/canals; install approximately 4 miles of new below-grade pipelines; construct and operate a new nominal 20,000 gpm central groundwater treatment facility using granular activated carbon; construct and operate local and/or wellhead treatment systems using air stripping with sufficient capacity to meet discharge goals in a coordinated program of treatment, blending, and/or priority pumping; obtain operating permit; monitor system performance and report results	Expected to achieve all preliminary ROs by removing COCs through extraction and treatment; protects human health and environment; prevents public exposure to COCs in groundwater; restores groundwater quality; prevents further groundwater contamination and protects unimpacted RID wells via source control and hydraulic plume containment; limits volatilization of VOCs from groundwater to air; results in a secure source of remediated water that is acceptable for all beneficial uses through permitted treatment, monitoring, and discharge	Minimal impact on land use in WVBA Site because remedy uses largely existing RID infrastructure; new pipelines will be installed in existing RID easements or new easements on public or private property; treatment facilities will likely require permits, property purchases or long-term access agreements; remedy consistent with all water use plans by restoring groundwater quality to meet all beneficial uses; significant declines in regional water levels not expected based on historical data	High degree of practicability; remedy uses existing infrastructure to the greatest extent possible; uses effective technologies that are proven and reliable; permits and access for new infrastructure can likely be obtained; professional services to design, construct, and operate remedy are available	Risks to public are effectively managed; remedy protects human health and environment over long-term through containment of impacted groundwater, extraction, and treatment; residual risk during remedy implementation and after remedy completion manageable; monitoring will ensure compliance with applicable State and Federal water quality standards	High degree of benefit; remedy restores groundwater quality; reduces risk to public and environment through treatment; mitigates impact on RID's operation and water supply and protects unimpacted wells; high degree of public acceptance expected; treated water available as a secure source of high quality water	**<u>PHASE 1</u>** Capital Cost: **$34 MM** Annual O&M Cost: **$4 - $5 MM** 30-Year NPV O&M Cost: **$77 - $96 MM** Total Cost: **$111 - $130 MM** **<u>PHASE 2</u>** Capital Cost: **$5 - $13 MM** Annual O&M Cost: **$0.4 - $1.5 MM** 30-Year NPV O&M Cost: **$8 - $29 MM** Total Cost: **$13 - $42 MM** **<u>TOTAL</u>** Capital Cost: **$39 - $47 MM** Annual O&M Cost: **$4.4 - $5.5 MM** 30-Year NPV O&M Cost: **$85 - $125 MM** Total Cost: **$124 - $172 MM**

Footnotes:
MM - Millions of dollars
O&M - Operation and maintenance
NPV = Net present value

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TABLE 2
SUMMARY OF PROPOSED ROOSEVELT IRRIGATION DISTRICT GROUNDWATER RESPONSE ACTION

ROOSEVELT IRRIGATION DISTRICT
GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN AREA WATER QUALITY ASSURANCE REVOLVING FUND SITE

PHASE		WELL NAME	ESTIMATED PUMPING RATE (gallons per minute) [1]	TOTAL VOC CONCENTRATION (micrograms per liter) [2]		ESTIMATED MASS OF TOTAL VOCs REMOVED (pounds per year)[3]
PHASE 1 EARLY RESPONSE ACTION	1A Pump and treat impacted groundwater from RID wells located along Van Buren Street	RID-105	1,900		5	44
		RID-106	1,500		61	397
		RID-107	2,100		51	464
		RID-108	1,900		63	526
		RID-109	2,400		22	234
		RID-110	2,900		14	180
		RID-112	1,700		31	231
		RID-113	2,300		44	443
		RID-114	2,500		110	1,202
		SUBTOTAL	19,200	AVG [4]	44	3,722
	1B Pump and treat impacted groundwater from RID wells with highest VOC concentrations	RID-89 [5]	2,900		51	652
		RID-92	1,200		119	624
		RID-95 [5]	1,700		80	593
		RID-100	2,100		65	599
		RID-106	1,500		61	397
		RID-107	2,100		51	464
		RID-108	1,900		63	526
		RID-112	1,700		31	231
		RID-113	2,300		44	443
		RID-114	2,500		110	1,202
		SUBTOTAL	19,900	AVG [4]	66	5,732
PHASE 2 SUPPLEMENTAL RESPONSE ACTIONS Enhanced wellfield management to reduce VOC concentrations in impacted groundwater discharged to RID Main Canal to acceptable levels by treatment, blending, and/or priority pumping		RID-84	2,400	The degree of treatment required to meet the Phase 2 objectives is unknown at this time. For planning and cost estimating purposes, it was assumed that four low-profile air strippers would be constructed to treat impacted groundwater from RID wells 84, 99, 102, and 104. In this case, an estimated total of approximately 600 pounds of total VOCs would be treated annually from Phase 2 operations.			
		RID-99	2,400			
		RID-102	3,900			
		RID-104	3,600			
		RID-109 [6]	2,400			
		RID-110 [6]	2,900			
		RID-111	see note 7			
		SUBTOTAL	17,600			
TOTAL (PHASES 1B AND 2)			37,500	AVG [4]	35	5,732

Footnotes:
1 - Pumping rates based on data provided by RID for 2008 and 2009.
2 - Sum of all detected VOCs; concentrations based on most recent analytical data available for each well.
3 - Total VOC removal in early years of remedy assuming all impacted wells from Phase 1A and 1B are pumped continously and all water is treated; actual mass removal may vary depending on demand for treated water.
4 - Pumping rate weighted average concentration in micrograms per liter assuming no loss due to volatilization or degradation.
5 - Pumping rates shown are 75% of reported rates; well testing and modification may be conducted to seal off lower portion of wells to optimize pumping of impacted groundwater.
6 - Wellhead and/or discharge infrastructure modifications may be required to blend impacted water from these wells with clean water from RID-88 and RID-91 before discharge to RID Main Canal.
7 - RID-111 is currently inoperable. A new replacement well may be drilled outside the plume to restore the lost water supply from RID-111 to RID.
Abbreviations:
RID - Roosevelt Irrigation District
VOC - Volatile organic compounds

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R. 1 E. R. 2 E. R. 3 E.

T. 2 N. T. 1 N.

Camelback Rd
Campbell Ave
Indian School Rd
Thomas Rd
McDowell Rd
Van Buren St
Buckeye Rd
Lower Buckeye Rd
Broadway Rd

Salt River Project Grand Canal
RID Main Canal
RID Salt Canal
Salt River

West Central Phoenix WQARF Site

West Van Buren Area WQARF Site

Motorola 52nd Street Superfund Site Operable Unit 3 Boundary

City of Phoenix 23rd Avenue WWTP

RID-83 RID-84 RID-85 RID-86 RID-87 RID-88 RID-89 RID-90 RID-91 RID-92 RID-93 RID-94 RID-95 RID-96 RID-97 RID-98 RID-99 RID-100 RID-101 RID-102 RID-103 RID-104 RID-105 RID-106 RID-107 RID-108 RID-109 RID-110 RID-111 RID-112 RID-113 RID-114

101 10 17 51 202

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

Grand Ave

Sky

EXPLANATION

- Roosevelt Irrigation District Well
- Monitor Well
- Existing Canal or Pipeline
- Interstates
- Local Streets
- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Abbreviations

WVBA - West Van Buren Area
WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District

N

0 5,000 Feet

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Study Area

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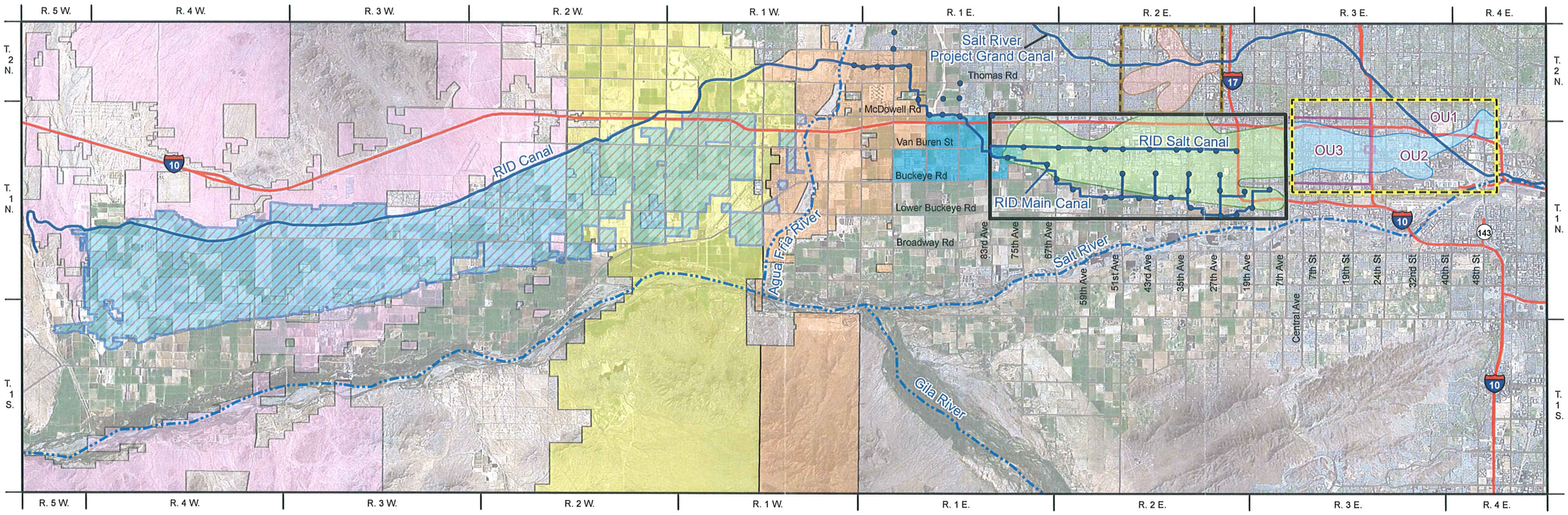
Water Resource Consultants

2009

FIGURE 1

G:\GIS-Tuc\Projects\802\03\Site_Map_Fig1_StudyArea_2.mxd\17Sept2009



EXPLANATION

- Roosevelt Irrigation District
- City of Goodyear Boundary
- City of Avondale Boundary
- Town of Buckeye Boundary
- City of Tolleson Boundary
- Interstates
- Local Streets
- Roosevelt Irrigation District Well
- West Van Buren WQARF Site
- Motorola 52nd Street Superfund Site
- West Central Phoenix WQARF SIte
- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Abbreviations

WQARF - Water Quality Assurance Revolving Fund
OU - Operable Unit
RID - Roosevelt Irrigation District

N

0 3
Miles

DRAFT

Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Regional Conditions

2009

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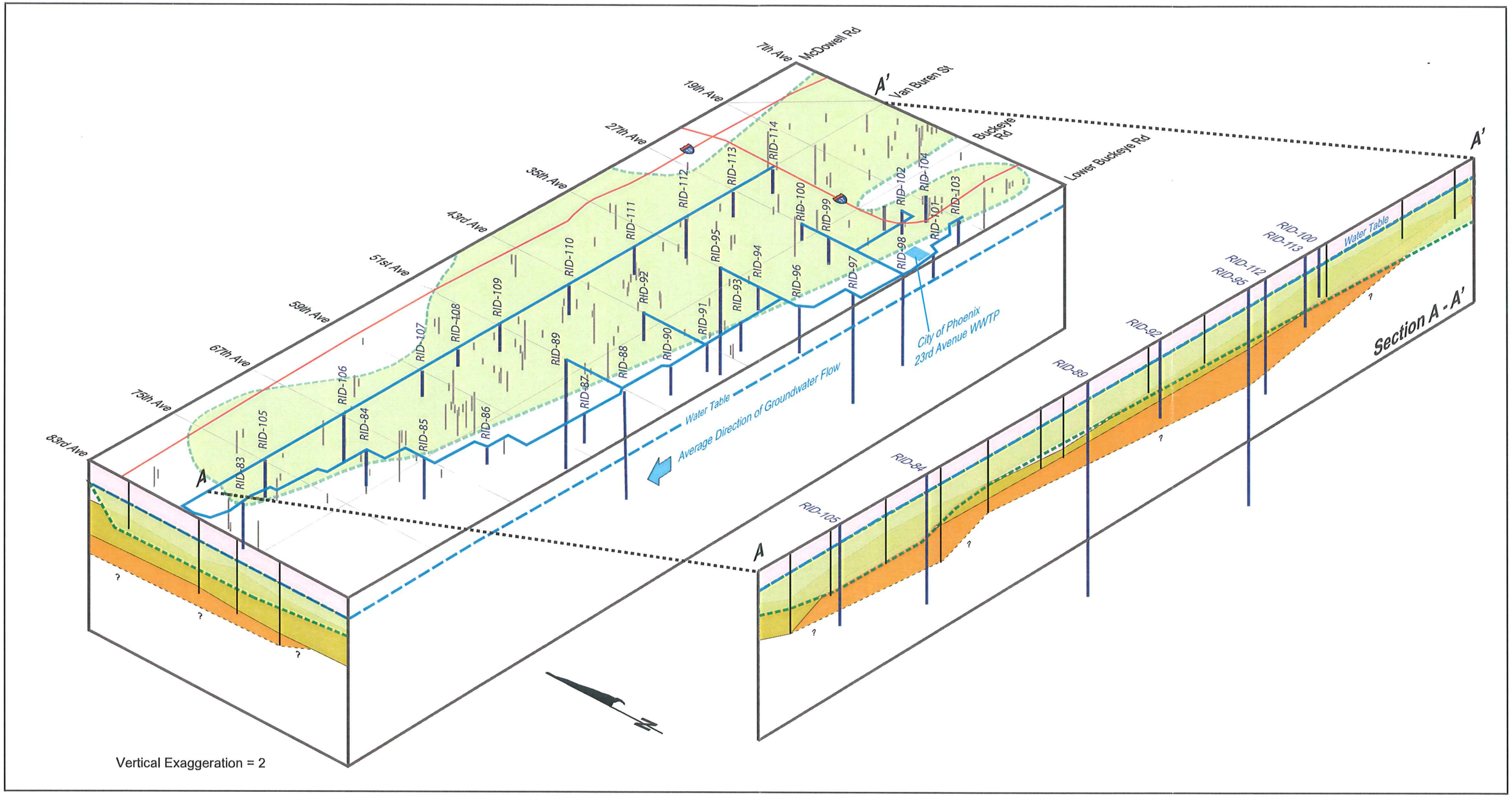
FIGURE 2

G:\GIS-Tuc\Projects\802\02\Site_Map_FigES2_RegionalStudyArea_2.mxd\23Sept2009



EXPLANATION

- Upper Alluvial Unit 1 (UAU1)
- Upper Alluvial Unit 2 (UAU2)
- Middle Alluvial Unit (MAU)
- Estimated Extent of Impacted Groundwater In WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)

- Existing Canal or Pipeline
- Interstates
- Local Streets
- Roosevelt Irrigation District Well
- Monitor Well

Abbreviations
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Conceptual Site Model

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Water Resource Consultants

2009

FIGURE 3

G:/GIS-Tuc\Projects\802\02\Site_Map_ConceptualSiteModel_ERA.cdr\15Sept2009

R. 1 E. R. 2 E. R. 3 E.

T. 2 N. T. 1 N.

Camelback Rd
Campbell Ave
Indian School Rd
Thomas Rd
McDowell Rd
Van Buren St
Buckeye Rd
Lower Buckeye Rd
Broadway Rd

Salt River Project Grand Canal
RID Main Canal
RID Salt Canal
Grand Ave
Salt River

West Central Phoenix WQARF Site
West Van Buren Area WQARF Site
Motorola 52nd Street Superfund Site Operable Unit 3 Boundary
City of Phoenix 23rd Avenue WWTP

Total VOC Concentrations (based on 1st Quarter 2008 data)

- Data Not Available for Quarter
- VOCs Not Detected
- >0.5 to 1 ug/L
- 1 to 10 ug/L
- 10 to 100 ug/L
- > 100 ug/L

VOC Data from Draft RI Report (Terranext, 2008a)

EXPLANATION

- Roosevelt Irrigation District Well
  - RID-89 - Well ID
  - 3,900 - Estimated Pumping Rate (gpm)
  - 51 - Total 2008 VOC Concentration (ug/L) (ND = Not Detected, NS = Not Sampled)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site
- Existing Canal or Pipeline
- Interstates
- Local Streets

Abbreviations

WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District
gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
VOC - Volatile Organic Compound
RI - Remedial Investigation

N

0 5,000 Feet

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Total Volatile Organic Compounds
Upper Alluvial Unit 1
First Quarter 2008

2009

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FIGURE 4

G:\GIS-Tuc\Projects\802\03\Site_Map_Fig4_Total_VOC_UAU1_2.mxd\15Sept2009

R. 1 E. R. 2 E. R. 3 E.

T. 2 N. T. 1 N.

Total VOC Concentrations (based on 1st Quarter 2008 data)

- Data Not Available for Quarter
- VOCs Not Detected
- >0.5 to 1 ug/L
- 1 to 10 ug/L
- 10 to 100 ug/L
- > 100 ug/L

VOC Data from Draft RI Report (Terranext, 2008a)

Camelback Rd
Campbell Ave
Indian School Rd
Thomas Rd
McDowell Rd
Van Buren St
Buckeye Rd
Lower Buckeye Rd
Broadway Rd

Salt River Project Grand Canal
West Central Phoenix WQARF Site
Grand Ave
Motorola 52nd Street Superfund Site Operable Unit 3 Boundary
RID Main Canal
RID Salt Canal
West Van Buren Area WQARF Site
City of Phoenix 23rd Avenue WWTP
Salt River

101 10 17 202

AVB129-02 ND
AVB91-02 7.6
AVB96-02 2.9
AVB98-01 1.5
AVB66-02 0
PTG-1B 6.1
AVB128-01 5.3
AVB131-01 1
AVB124-01 133.2
AVB124-02 ND
AVB132-01 80.8
AVB132-02 0.9
AVB134-02 143.4
AVB116-02 125.2
AVB77-02 ND
AVB106-03 ND
AVB81-01 ND
AVB10-02 13.3
DMW-1 10.8
DMW-2 34.1
DMW-3 1.3
PTG-2B 3.7
AVB122-03 1.6
AVB137-01 ND
AVB120-02 197.9
PW-4
AVB136-01 34.2
AVB121-02 ND
AVB126-02 34
AVB69-01 ND
CMW-1D

RID-105 1,900 5
RID-106 1,500 61
RID-107 2,100 51
RID-108 1,900 63
RID-109 2,400 22
RID-110 2,900 14
RID-111 Inoperable
RID-112 1,700 31
RID-113 2,300 44
RID-114 2,500 110
RID-83 2,300 NS
RID-84 2,400 12
RID-85 2,600 ND
RID-86 3,600 ND
RID-87 2,000 NS
RID-88 2,000 ND
RID-89 3,900 51
RID-90 2,500 NS
RID-91 3,200 NS
RID-92 1,200 119
RID-93 4,000 ND
RID-94 3,300 3
RID-95 2,300 80
RID-96 3,000 NS
RID-97 3,200 ND
RID-98 3,800 NS
RID-99 2,400 11
RID-100 2,100 65
RID-101 4,500 2
RID-102 3,900 12
RID-103 2,200 2
RID-104 3,600 11

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

EXPLANATION

- Roosevelt Irrigation District Well
  - RID-89 - Well ID
  - 3,900 - Estimated Pumping Rate (gpm)
  - 51 - Total 2008 VOC Concentration (ug/L) (ND = Not Detected, NS = Not Sampled)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site
- Existing Canal or Pipeline
- Interstates
- Local Streets

Abbreviations

WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District
gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
VOC - Volatile Organic Compound
RI - Remedial Investigation

N

0 5,000 Feet

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Total Volatile Organic Compounds Upper Alluvial Unit 2 First Quarter 2008

2009

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FIGURE 5

G:\GIS-Tuc\Projects\802\03\Site_Map_Fig5_Total_VOC_UAU2_2.mxd\15Sept2009

R. 1 E. R. 2 E. R. 3 E.

T. 2 N. T. 1 N.

Total VOC Concentrations (based on 1st Quarter 2008 data)

- Data Not Available for Quarter
- VOCs Not Detected
- >0.5 to 1 ug/L
- 1 to 10 ug/L
- 10 to 100 ug/L
- > 100 ug/L

VOC Data from Draft RI Report (Terranext, 2008a)

Camelback Rd
Indian School Rd
Thomas Rd
McDowell Rd
Van Buren St
Buckeye Rd
Lower Buckeye Rd
Broadway Rd
Campbell Ave.
Salt River Project Grand Canal
West Central Phoenix WQARF Site
Grand Ave
Motorola 52nd Street Superfund Site Operable Unit 3 Boundary
RID Main Canal
RID Salt Canal
West Van Buren Area WQARF Site
City of Phoenix 23rd Avenue WWTP
Salt River
Sky

101 10 17 202

RID-105 1,900 5
AVB82-02 5.5
RID-107 2,100 51
RID-108 1,900 63
RID-109 2,400 22
RID-110 2,900 14
RID-111 Inoperable
RID-112 1,700 31
RID-113 2,300 44
RID-114 2,500 110
AVB60-01 1.3
AVB82-01 99.9
RID-106 1,500 61
AVB61-01 ND
RID-83 2,300 NS
RID-84 2,400 12
DIMW-9D ND
DIMW-2 34.1
DIMW-8D ND
DIMW-1 10.8
DIMW-3 1.3
PTG-2B 3.7
RID-85 2,600 ND
RID-89 3,900 51
PW-4
RID-92 1,200 119
RID-95 2,300 80
RID-100 2,100 65
AVB126-03 ND
AVB68-04 ND
RID-102 3,900 12
RID-104 3,600 11
AVB69-01 ND
RID-86 3,600 ND
RID-87 2,000 NS
RID-88 2,000 ND
RID-90 2,500 NS
RID-91 3,200 NS
RID-93 4,000 ND
RID-94 3,300 3
RID-99 2,400 110.6
RID-96 3,000 NS
RID-97 3,200 ND
RID-103 2,200 2
RID-101 4,500 2
RID-98 3,800 NS

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

EXPLANATION

- Roosevelt Irrigation District Well
  - RID-89 - Well ID
  - 3,900 - Estimated Pumping Rate (gpm)
  - 51 - Total 2008 VOC Concentration (ug/L) (ND = Not Detected, NS = Not Sampled)
- Existing Canal or Pipeline
- Interstates
- Local Streets
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Abbreviations

WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District
gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
VOC - Volatile Organic Compound
RI - Remedial Investigation

N

0 5,000 Feet

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Total Volatile Organic Compounds Middle Alluvial Unit First Quarter 2008

2009

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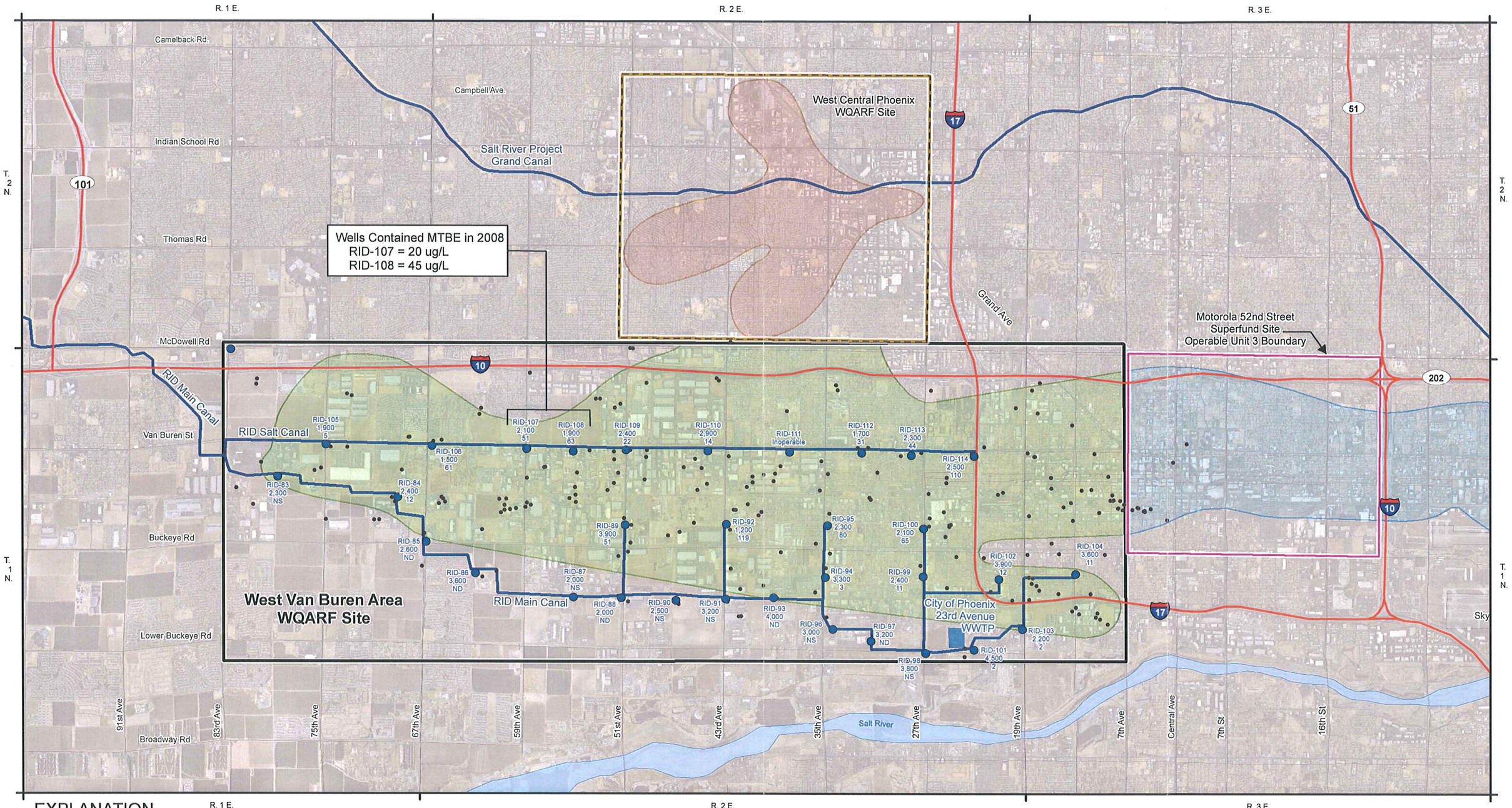
FIGURE 6

G:\GIS-Tuc\Projects\802\03\Site_Map_Fig6_Total_VOC_MAU_2.mxd\15Sept2009



EXPLANATION

- Roosevelt Irrigation District Well
  - RID-89 - Well ID
  - 3,900 - Estimated Pumping Rate (gpm)
  - 51 - Total 2008 VOC Concentration (ug/L)
    (ND = Not Detected, NS = Not Sampled)
- Existing Canal or Pipeline
- Interstates
- Local Streets
- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site
- Monitor Well

Abbreviations

WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District
gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
MTBE - Methyl Tertiary Butyl Ether

N

0 5,000
Feet

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Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Impact on Roosevelt Irrigation District Wells

2009

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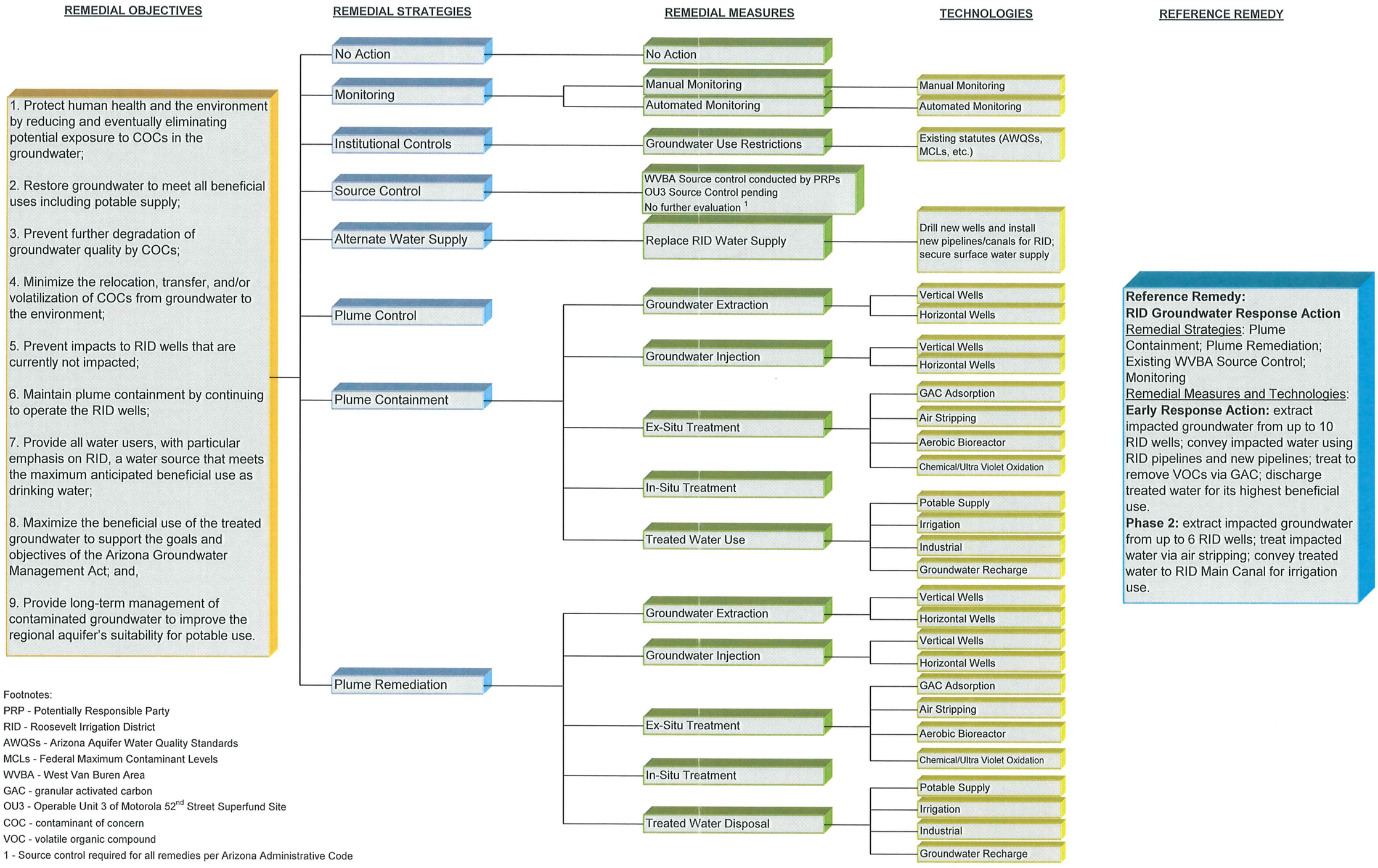
FIGURE 7

G:\GIS-Tuc\Projects\802\03\Site_Map_Fig7_ImpactOnRIDWells_2.mx10Sept2009



Footnotes:
PRP - Potentially Responsible Party
RID - Roosevelt Irrigation District
AWQSs - Arizona Aquifer Water Quality Standards
MCLs - Federal Maximum Contaminant Levels
WVBA - West Van Buren Area
GAC - granular activated carbon
OU3 - Operable Unit 3 of Motorola 52nd Street Superfund Site
COC - contaminant of concern
VOC - volatile organic compound
1 - Source control required for all remedies per Arizona Administrative Code

FIGURE 8. DEVELOPMENT OF REFERENCE REMEDY
ROOSEVELT IRRIGATION DISTRICT GROUNDWATER RESPONSE ACTION IMPLEMENTATION PLAN
WEST VAN BUREN AREA WATER QUALITY REVOLVING FUND SITE

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R. 1 E. R. 2 E. R. 3 E.

T. 2 N. T. 1 N.

Camelback Rd
Indian School Rd
Thomas Rd
McDowell Rd
Buckeye Rd
Lower Buckeye Rd
Broadway Rd
Van Buren St
Campbell Ave
Grand Ave
Salt River Project Grand Canal
RID Main Canal
RID Salt Canal
Proposed Treatment Plant
West Central Phoenix WQARF Site
West Van Buren Area WQARF Site
Motorola 52nd Street Superfund Site Operable Unit 3 Boundary
City of Phoenix 23rd Avenue WWTP
Salt River
Sky

101 10 17 51 202

RID-105 1,900 5
RID-106 1,500 61
RID-107 2,100 51
RID-108 1,900 63
RID-109 2,400 22
RID-110 2,900 14
RID-111 Inoperable
RID-112 1,700 31
RID-113 2,300 44
RID-114 2,500 110
RID-83 2,300 NS
RID-84 2,400 12 AS
RID-85 2,600 ND
RID-86 3,600 ND
RID-87 2,000 NS
RID-88 2,000 ND
RID-89 3,900 51
RID-90 2,500 NS
RID-91 3,200 NS
RID-92 1,200 119
RID-93 4,000 ND
RID-94 3,300 3
RID-95 2,300 80
RID-96 3,000 NS
RID-97 3,200 ND
RID-98 3,800 NS
RID-99 2,400 11 AS
RID-100 2,100 65
RID-101 4,500 2
RID-102 3,900 12 AS
RID-103 2,200 2
RID-104 3,600 11 AS

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

EXPLANATION

Roosevelt Irrigation District Well
RID-89 - Well ID
3,900 - Estimated Pumping Rate (gpm)
51 - Total 2008 VOC Concentration (ug/L)
(ND = Not Detected, NS = Not Sampled)

Existing Canal or Pipeline
Proposed New Below-Grade Pipeline
Interstates
Local Streets

Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site

Monitor Well

Abbreviations
WVBA - West Van Buren Area
WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District
gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
OU3 - Operable Unit 3

Phase 1 (Early Response Action)
Phase 2 (Supplemental Response Actions)
AS Wellhead Air Stripper

N

0 5,000 Feet

DRAFT

G:\GIS-Tuc\Projects\802\02\Site_Map_Fig9_PropRID_GRA.mxd\17Sept2009

Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Proposed Roosevelt Irrigation District Groundwater Response Action

2009

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FIGURE 9

R. 1 E. R. 2 E. R. 3 E.

T. 2 N.

T. 1 N.

Camelback Rd.
Campbell Ave.
Indian School Rd
Thomas Rd
McDowell Rd
Buckeye Rd
Lower Buckeye Rd
Broadway Rd
Van Buren St

101 17 51 10 202

Salt River Project Grand Canal

West Central Phoenix WQARF Site

Grand Ave

Motorola 52nd Street Superfund Site Operable Unit 3 Boundary

Proposed Treatment Plant

RID Main Canal

RID Salt Canal

RID-105 1,900 5
RID-106 1,500 61
RID-107 2,100 51
RID-108 1,900 63
RID-109 2,400 22
RID-110 2,900 14
RID-111 Inoperable
RID-112 1,700 31
RID-113 2,300 44
RID-114 2,500 110
RID-83 2,300 NS
RID-84 2,400 12
RID-85 2,600 ND
RID-86 3,600 ND
RID-87 2,000 NS
RID-88 2,000 ND
RID-89 3,900 51
RID-90 2,500 NS
RID-91 3,200 NS
RID-92 1,200 119
RID-93 4,000 ND
RID-94 3,300 3
RID-95 2,300 80
RID-96 3,000 NS
RID-97 3,200 ND
RID-98 3,800 NS
RID-99 2,400 11
RID-100 2,100 65
RID-101 4,500 2
RID-102 3,900 12
RID-103 2,200 2
RID-104 3,600 11

West Van Buren Area WQARF Site

City of Phoenix 23rd Avenue WWTP

RID Main Canal

Salt River

91st Ave 83rd Ave 75th Ave 67th Ave 59th Ave 51st Ave 43rd Ave 35th Ave 27th Ave 19th Ave 7th Ave Central Ave 7th St 16th St

Sky

EXPLANATION

- Roosevelt Irrigation District Well
  - RID-89 - Well ID
  - 3,900 - Estimated Pumping Rate (gpm)
  - 51.4 - Total 2008 VOC Concentration (ug/L)
    (ND = Not Detected, NS = Not Sampled)
- Existing Canal or Pipeline
- Proposed New Below-Grade Pipeline
- Interstates
- Local Streets
- Estimated Extent of Impacted Groundwater in WVBA WQARF Site Based on 1st Quarter 2008 Data (Terranext, 2008a)
- Estimated Extent of Impacted Groundwater in West Central Phoenix WQARF Site
- Estimated Extent of Impacted Groundwater in Motorola 52nd Street Superfund Site
- Monitor Well

Abbreviations
WVBA - West Van Buren Area
WQARF - Water Quality Assurance Revolving Fund
WWTP - Waste Water Treatment Plant
RID - Roosevelt Irrigation District
gpm - Gallons Per Minute
ug/L - Micrograms Per Liter
OU3 - Operable Unit 3

Early Response Action
(see Table 2 for a summary of phased implementation)

N

0 5,000
Feet

DRAFT

Roosevelt Irrigation District
Groundwater Response Action
Implementation Plan
West Van Buren Area WQARF Site

Early Response Action

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2009

FIGURE 10

G:\GIS-Tuc\Projects\802\03\Site_Map_Fig10_RID_GRA.mxd\17Sept2009