RECLAMATION

Managing Water in the West

WaterSMART Grant FY2011: Vadose Zone Recharge Wells City of Surprise

Maricopa County, Arizona

Environmental Assessment

U.S. Department of the Interior
Bureau of Reclamation

December 2011

Mission Statements

The mission of the Department of the interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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ABBREVIATIONS AND ACRONYMS

ADEQ	Arizona Department of Environmental Quality
ADWR	Arizona Department of Water Resources
AF	acre-feet
AFA	acre-feet annually
AMA	Active Management Area
AOI	Area of Impact
APP	Aquifer Protection Permit
AZPDES	Arizona Pollutant Discharge Elimination System
CAP	Central Arizona Project
City	City of Surprise
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
MCL	maximum contaminant level
mg/l	milligrams per liter
mg/m3	milligrams per cubic meter
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
pH	A measure of the acidity or basicity of a solution.
PM	particulate matter
PM_{10}	particulate matter with a diameter of 10 microns
$PM_{2.5}$	particulate matter with a diameter of 2.5 microns
ppb	parts per billion
ppm	parts per million
Reclamation	U.S. Bureau of Reclamation
TDS	total dissolved solids
µg/m3	micrograms per cubic meter
USF	Underground Storage Facility
WRCC	Western Regional Climate Center
WSRV	West Salt River Valley

UNIT CONVERSION GUIDE

For the reader's convenience, the following table has been included to serve as a guide in converting measurements found in this document between U.S. measurements and metric.

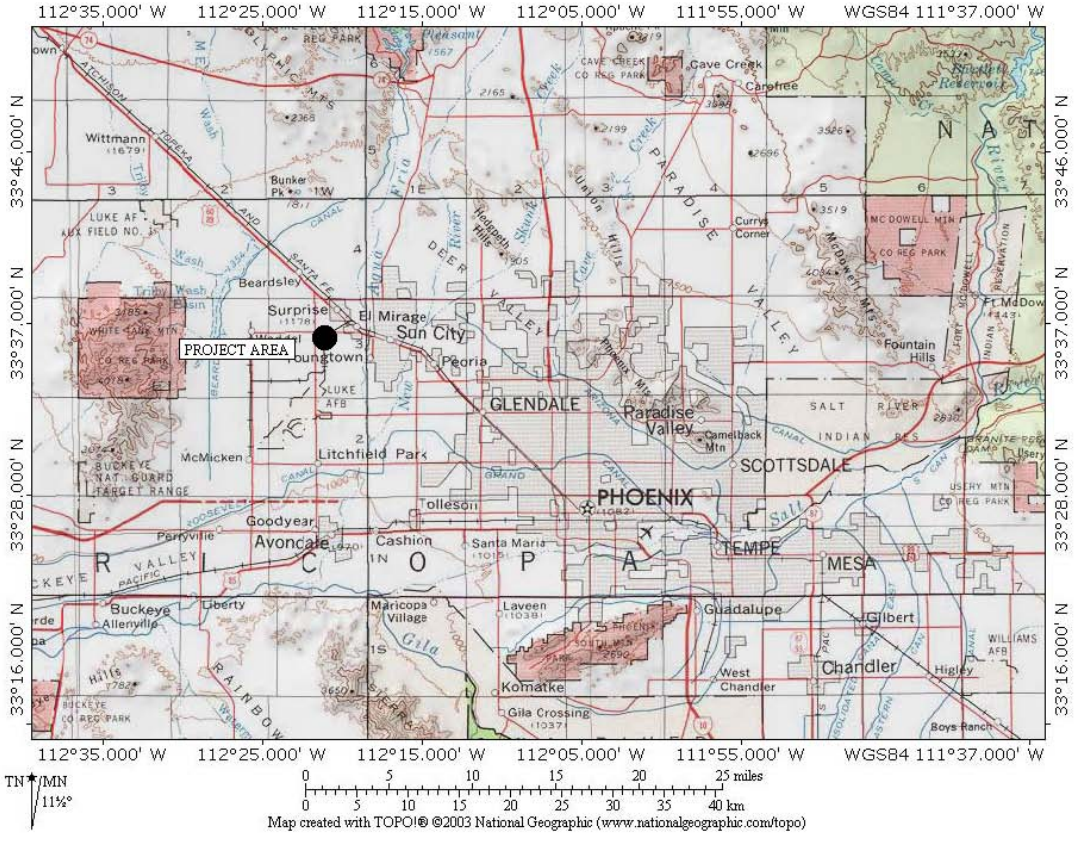
CONVERSION OF U.S. TO METRIC MEASUREMENTS	
U.S. Measurement	**Metric Measurement**
DISTANCE	
1 inch	2.54 centimeters
1 foot	0.31 meter
+/-1 mile	1.61 kilometers
AREA	
1 square foot	0.09 square meter
1 acre	0.41 hectare
CONVERSION OF METRIC TO U.S. MEASUREMENTS	
Metric Measurement	**U.S. Measurement**
DISTANCE	
1 centimeter	0.39 inch
1 meter	3.28 feet
1 kilometer	0.62 mile
AREA	
1 square meter	10.76 square feet
1 hectare	2.47 acres

I. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

A. Background and Project Location

In 2009, the City of Surprise (City) constructed five vadose zone recharge wells at its South Plant Water Reclamation Facility (WRF); the City has operated them as a pilot project since that time. The WRF is located in the vicinity of Cactus and Litchfield Park roads, in Maricopa County, Arizona (Figure 1). Approximately 2,000 acre-feet (AF) annually (AFA) of reclaimed water generated from the WRF are recharged at this location by the five wells (403.25 AFA for each well). The City recently received a $1 million grant from the U.S. Bureau of Reclamation's (Reclamation) Fiscal Year 2011 WaterSMART – Water and Energy Efficiency Grants program. Through this grant, the City intends to construct and operate 15 additional vadose zone wells, increasing the amount of reclaimed water that can be recharged annually by about 6,049 AFA. This would enable the City to recharge up to a total maximum of 8,049 AFA of reclaimed water that would be stored underground for later City use.

Figure 1. General Location Map



B. Purpose and Need

The City's purpose of the project is to increase the number of vadose zone wells it operates, in order to more effectively manage its water resources and meet the City's projected future water supply needs. The annual base population of approximately 110,000 people, located within the City's 30-square-mile water service area, increases to over 125,000 people during winter months. Currently, the City's water service area is supplied exclusively by ground water. The WRF currently treats an average of 7.6 million gallons per day (mgd), or 8,511 AFA. The total monthly amount of flow treated by the WRF fluctuates significantly throughout the year due to the seasonal population increase during winter, with peak flows of about 8 mgd occurring during the winter months.

The WRF presently generates approximately 7,618 AFA of reclaimed water. The City has several accounts with subdivision homeowner associations (HOA) that receive reclaimed water as needed for irrigation purposes; however,there are no specific contracts to deliver a set amount of water at any given time. The HOA accounts are currently using between 300 and 400 AFA, depending upon seasonal demands for water. As noted above, an additional estimated 2,000 AFA of reclaimed water are recharged through the five existing vadose zone wells. There are also two recharge basins located on the South Plant WRF property, which recharge an additional 2,968 AFA. Any remaining reclaimed water that is not used directly or cannot be recharged by the City using either the vadose zone wells or the recharge basins is delivered to nearby agricultural fields to irrigate non-food crops such as cotton and roses. The amount delivered to the agricultural fields varies between 138 and 195 AF per month, averaging about 2,220 AFA.

There is an imbalance between supply of and demand for reclaimed water over the course of any given year. This is especially true during winter months, when the City population and potable water use increases, but the need for reclaimed water for both HOA and agricultural purposes decreases. As urbanization occurs over time, agriculture in the area will decrease and population and potable water use will increase, resulting in an even greater imbalance in reclaimed water production and direct use. Increasing the capacity for recharging reclaimed water will allow Surprise to more effectively manage its use of reclaimed water and maximize its ability to obtain State issued long-term storage credits now and into the future.

The purpose of this environmental assessment (EA) is to describe and address potential environmental impacts resulting from the City's use of federal funding to construct and operate the additional vadose zone wells at the WRF. Reclamation is preparing the EA in compliance with the National Environmental Policy Act of 1969, as amended (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA, and amendments of the Department of Interior's regulations for implementing NEPA (73 Federal Register [FR] 61292; October 15, 2008).

II. PROPOSED ACTION AND NO ACTION ALTERNATIVE

A. Proposed Action

Under the proposed project, the City would install and operate up to 15 vadose zone recharge wells at its South WRF (Figure 2). The construction period would be about 12 months, with the wells becoming operational in March 2013. These new wells would be similar to and located in the same vicinity as the five wells that were installed at the WRF in 2009. The wells would be spaced approximately 100 feet apart from one another. Each well would be capable of recharging about 250 gallons per minute (gpm); at optimum recharge rates and if operated continually, each well would recharge 403.25 AFA per well. Construction and operation of the proposed project would result in a maximum of about 6,049 AFA being recharged to the underlying aquifer, if all wells are operated continually; including the 2,000 AFA that are recharged using the existing vadose zone wells, the maximum total amount that could be recharged would be about 8,049 AFA.

Figure 2. Vadose Zone Wellfield and Monitoring Well Locations

Section 22, T. 3N, R. 1W,

The major facilities that would be installed and major construction activities include the following:

1. Each vadose zone well would be drilled to a depth of 180 feet below ground surface (bgs), with a borehole diameter of 48 inches. No drill water would be used. A 12-inch diameter polyvinyl chloride (PVC) well casing would be installed inside the well shaft, from 1 foot above the bottom of the borehole to about 1 foot above ground. The lower 100 feet of the well casing would be perforated and surrounded by pea-sized gravel pack.

A single 6-inch diameter PVC injection line would be installed inside the 12-inch diameter well casing. It would extend from the top of the casing down to within 3 feet of the bottom of the well casing.

Two 3-inch diameter PVC open-ended gravel pack injection lines would be installed to a depth of 40 feet inside the gravel pack material. The bottom 10 feet of these two lines would be perforated; the upper 30 feet would be unperforated. These lines would be used during rehabilitation and chemical treatment of the wells. The upper 10 feet of these two injection lines would be steel, since they would be exposed to the sun.

Each well would be completed above-ground on a concrete slab, approximately 13 feet long by 9 feet wide. Electrical components of the well would be mounted above-ground in a water-proof temperature controlled enclosure. Each well would have light fixtures that would be controlled by a photo sensor or toggle switch.

Construction of the wells would occur within a 10-acre parcel that was previously graded and bermed (wellfield).

2. A 6-inch diameter steel injection manifold would connect the injection line to the distribution pipeline.

3. A 20-inch diameter looped piping manifold would be installed to distribute water to all of the vadose zone wells. Each of the piping loops would have a flush point to allow the pipeline to be flushed on a periodic basis. Flush water would be disposed of at each site on an individual basis to an existing sewer line that connects to the WRF.

4. A 20-inch diameter pipeline, that delivers reclaimed water from the WRF to the existing five vadose zone wells, would be extended to loop around the entire 10-acre parcel. The 15 new wells to be constructed under the proposed action would be connected to this delivery pipeline. The pipeline would be buried at an average depth of about 5 feet bgs. Connections and and stub-outs would be installed along the new pipeline, at each proposed well site.

About 1.3 acres would be disturbed within the bermed wellfield by excavation and installation of the delivery pipeline and vadose zone wells.

Vadose zone wellfield operations would consist of the following:

5. Two existing lined storage basins (5-million gallons and 10-million gallons) store treated reclaimed water at the southern end of the City's WRF property. Once the reclaimed water level exceeds a certain elevation, the booster pumps would engage, and reclaimed water from the storage basins would be delivered to a group of three to five vadose zone wells, which would be operated as a unit. The system would be operated either in an automated mode, or manually by an operator.

6. Once the storage basin level(s) has returned to a pre-determined operating range, the wellfield would either be automatically shut down in the reverse order of start-up, or shut down by the operator.

B. No Action

Under the No Action Alternative, the City would continue installation of the remaining vadose zone recharge wells originally proposed, but over a longer period of time. The same construction- and operation-related activities would occur; however, they would occur later in time. Construction activities also could be staged so that only a few wells are constructed at a time, as funds become available. The City anticipates without Reclamation's additional funding assistance, the 15 wells proposed to be installed under this proposed project would be constructed over the next 5 years.

III. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES[1]

Resources, which could be affected by the proposed project and are of primary concern include the following: Air quality, geology, water resources, and cultural resources. This section describes the existing conditions of these resources within the project area and the potential environmental consequences resulting from the construction and operation of the proposed recharge project. The consequences of the No Action Alternative also are described for each of the resources identified above, as a basis for comparing the potential impacts of the proposed project. Other resources such as biological resources, recreation and socioeconomic resources are not expected to be affected and are not discussed in detail in this EA.

Cumulative impacts, or effects, are the impacts on the environment which result from the incremental impacts of the proposed project when added to the impacts of other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions (40 CFR 1508.7). Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time. The geographical area impacted as a result of these other actions may differ depending upon the affected resource. The impacts also

[1]Unless otherwise noted, information provided was obtained from the City of Surprise "Application for Underground Storage Facility Permit and Water Storage Permit for an Underground Storage Facility," "Application for a State of Arizona Aquifer Protection Permit," and City of Surprise staff. Additional information was obtained from other studies related to this project; and/or through Reclamation staff field work and evaluation.

may vary temporally—at different times—depending upon the timing of the proposed action in relation to other present and reasonably foreseeable future actions. Although smaller areas might be more appropriate for some resources (such as cultural resources), for the discussion of cumulative impacts this EA utilizes the projected maximum area of impact and ground water level rise (AOI). The Arizona Department of Water Resources (ADWR) application for constructing an Underground Storage Facility (USF) permit requires a delineation of the project's AOI, which is defined as the area within which a 1-foot or more rise in the ground water table is projected to occur over the 20-year life of the facility permit. The AOI identified in Surprise's USF permit application is shown in Figure 3, and comprises a circle having a 6.9-mile radius with the proposed wellfield as its center.

The primary past and present actions in the impact area involve active agriculture as well as the urbanization of former agricultural lands. "Reasonably foreseeable future actions" are defined as actions that are not speculative—they have been approved, are included in short- to medium-term planning and budget documents prepared by government agencies or other entities, or are likely to occur given trends (Environmental Protection Agency [EPA] 1999). The most likely future actions within the immediate project area include development of any remaining vadose zone wells within the vadose zone recharge wellfield, up to the maximum number of wells, including replacement wells, allowed in the USF permit, and the system's long term operation, consistent with the City's USF and Aquifer Protection Permit (APP) permits. The remaining vacant land within the City's water treatment/reclamation facilities would be used to expand the treatment or storage capacities, if needed (L. Lambert, personal communication, December 12, 2011). Surprise's General Plan 2030 (Surprise 2008) indicates the agricultural fields in the vicinity surrounding the South Plant WRF would be developed into low density and suburban residential areas (agriculture-related residences or one resident per acre or less), and employment centers.[2]

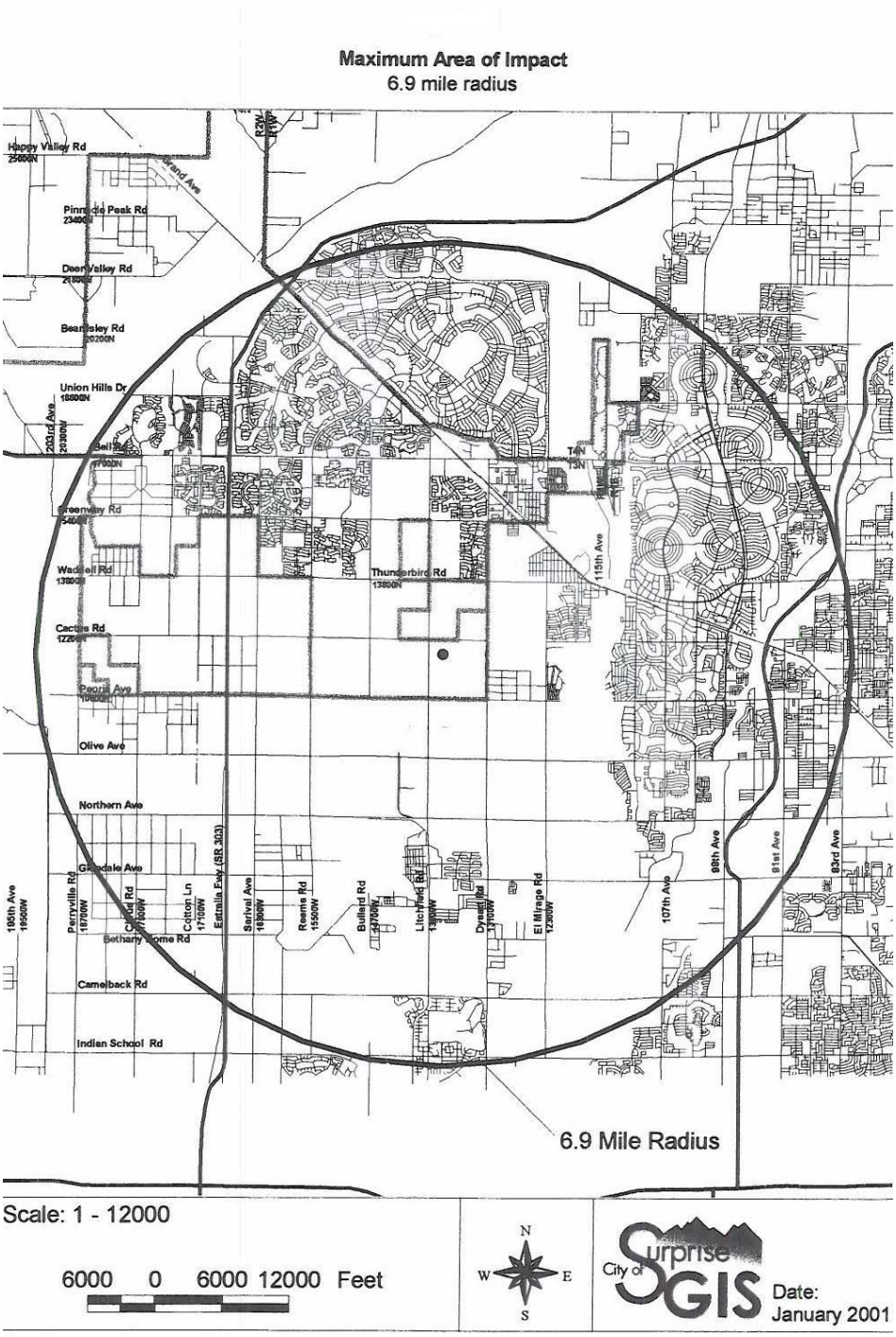
A. Climate and Air Quality

1. Affected Environment

The climate of the general project area is typical of arid southwestern deserts in the United States. It is characterized by hot, long summers; short, mild winters; sparse rainfall; low relative humidity; and high evaporation rates. The average (mean) annual temperature is almost 70° Fahrenheit (F); monthly average temperatures range from a high of about 105° F during summer, to a low of just under 69° F in the winter, as measured by the Western Regional Climate Center (WRCC) at Litchfield Park, Arizona (Station 024977; period of record 1917 to present). The highest temperature recorded during the period of record was 125° F (June 1990 and July 1995), while the lowest temperature recorded for the same period of record was 16° F (January 1950).

2 Employment centers are expected to contain prime industrial land that support export-oriented base sector activities, such as warehouse distribution, heavy or light manufacturing, research and development uses, and selected business services. (Surprise 2008)

Figure 3. Maximum Area of Impact



Typically in the desert southwest, the months experiencing the largest amounts of precipitation are December, January and February; however, at the Litchfield Park station, the months having the greatest measured precipitation for the period of record have been January, February, and August. Annual average rainfall in the project area is a little over eight inches.

The maximum annual precipitation occurred in 1992, when 19.09 inches were measured. The least amount of annual precipitation occurred in 1989, when only 1.87 inches were measured; however, measurements for 26 days or more during December were not available for 1989. The minimum amount of precipitation recorded for a year where no data are missing occurred in 1956, when 2.01 inches were measured. The maximum monthly precipitation of record occurred in September 1939, when 7.55 inches were measured. (WRCC 2011)

EPA has set National Ambient Air Quality Standards (NAAQS) for six criteria pollutants. These include carbon monoxide, nitrogen oxide, sulfur dioxide, lead, ozone, particulate matter (PM) less than 10 microns in diameter (PM_{10}), and PM less than 2.5 microns in diameter ($PM_{2.5}$). States are required to adopt standards that are at least as stringent as the NAAQS. In Arizona, ambient air quality standards are identical to the Federal NAAQS (Table 3-1).

The project area is located within an area designated as attaining the NAAQS for nitrogen oxide, sulfur dioxide, lead, and $PM_{2.5}$. The project area is included in the Maricopa County CO maintenance area, and is within the portion of Maricopa County designated as non-attainment for PM_{10} (serious) and ozone (8-hour standard) NAAQS.

2. Environmental Consequences

a. Proposed Action - Construction-related activities would generate PM as a result of land-disturbing activities, including but not limited to excavation and burial of the distribution pipeline, drilling for the wells, and stockpiling and transport of excess excavated material. Approximately 1.3 acres of land-disturbance would occur over a 12-month period of time. These impacts would be temporary.

Pursuant to the Clean Air Act, proposed federal projects located in designated NAAQS nonattainment or maintenance areas are required to conduct a conformity determination if the total direct and indirect emissions for a given criteria pollutant exceeds specific "*de minimis*" threshold rates. If it appears the threshold rate would be exceeded, a conformity determination is undertaken to ensure the project will conform to the State Implementation Plan's objectives of attaining the NAAQS in nonattainment or maintenance areas (i.e., to ensure the proposed project will not: cause or contribute to any new violations of the NAAQS; increase the frequency or severity of any existing violation of any standard in a given area; or delay timely attainment of any standard or interim emission reductions or other State Implementation Plan milestones). The project area is located within an area that is in non-attainment for PM_{10} and ozone, and in a CO maintenance area. To determine whether or not a conformity determination is required for PM_{10}, ozone, or CO, estimates of these emissions resulting from construction-related activities were calculated. Long-term operation of the wellfield is not anticipated to result in any additional land disturbance or increased vehicular traffic within the WRF property; therefore, emissions from long-term operations were not calculated.

Table 3-1. National Ambient Air Quality Standards

	Primary Standards		Secondary Standards	
Pollutant	Level	Averaging Time	Level	Averaging Time
Carbon Monoxide	9 ppm (10 mg/m³)	8-hour (1)	None	
	35 ppm (40 mg/m³)	1-hour (1)		
Lead	0.15 µg/m³ (2)	Rolling 3-Month Average	Same as Primary	
Nitrogen Dioxide	53 ppb (3)	Annual (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour (4)	None	
Particulate Matter (PM_{10})	150 µg/m³	24-hour (5)	Same as Primary	
Particulate Matter ($PM_{2.5}$)	15.0 µg/m³	Annual (6) (Arithmetic Average)	Same as Primary	
	35 µg/m³	24-hour (7)	Same as Primary	
Ozone	0.075 ppm (2008 std)	8-hour (8)	Same as Primary	
	0.08 ppm (1997 std)	8-hour (9)	Same as Primary	
	0.12 ppm	1-hour (10)	Same as Primary	
Sulfur Dioxide	0.03 ppm (11) (1971 std)	Annual (Arithmetic Average)	0.5 ppm	3-hour (1)
	0.14 ppm (11) (1971 std)	24-hour (1)		
	75 ppb (12)	1-hour	None	

(1) Not to be exceeded more than once per year.
(2) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m³ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.
(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).
(5) Not to be exceeded more than once per year on average over 3 years.
(6) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m³.
(7) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m³ (effective December 17, 2006).
(8) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm. (effective May 27, 2008)
(9) (a) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard.
(c) EPA is in the process of reconsidering these standards (set in March 2008).
(10) (a) EPA revoked the 1-hour ozone standard in all areas, although some areas have continuing obligations under that standard ("anti-backsliding").
(b) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1.
(11) The 1971 sulfur dioxide standards remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.
(12) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.
Source: EPA 2011

Table 3-2 indicates the *de minimis* threshold rates for PM_{10}, ozone, and CO, and a conservative (high) estimate of the amount of each pollutant that would result from construction-related activities. Because the amount of emissions that would be generated are well below the *de minimis* thresholds, a conformity determination is not necessary.

Table 3-2. Construction-Related Air Emission Estimates/*De Minimis* Threshold

POLLUTANT	ESTIMATED EMISSIONS	*DE MINIMIS THRESHOLD*
PM10 (serious non-attainment)	3.9 tons	70 tons/year
Ozone (VOC or NOx) (other areas outside an ozone transport region)	0.05 tons (VOC) 0.66 tons (NOx)	100 tons/year
CO (maintenance)	0.29 tons	100 tons/year

Operation of trucks and construction equipment also would generate minor amounts of air emissions, including hydrocarbons, carbon monoxide, nitrogen oxide, and sulfur dioxide, in addition to PM. Mobile sources are not subject to emission limitations; however the Contractor would be required to comply with all Federal, State and local air quality regulations, obtain all applicable dust abatement permits and minimize dust generation, and follow best management practices to maintain all motorized equipment in good working order to minimize emissions (L. Lambert, 2011). These temporary air pollutant emissions would contribute insignificantly to the county-wide emissions for the 12-month construction period.

Operation of the vadose zone wellfield would result in little to no additional air emissions. All power would be supplied by existing transmission lines.

b. No Action – Under the No Action alternative, the same construction-related land-disturbing activities would occur; however, these activities would likely occur later in time, and could be completed in several phases over a 5-year period of time. The piecemeal construction would result in multiple equipment mobilizations and construction activities over a 5-year time period. This would potentially result in somewhat more fossil fuel use, as well as generation of dust and other emissions sporadically over a longer period of time, rather than constantly over a shorter period of time. Continued use of the recharge basins would be more labor intensive and result in greater energy use (for basin scarification and weed control) than the vadose zone wells. Maintenance of the recharge basins also would result in some, although nominal, dust emissions.

3. Cumulative Effects

Continued farming operations and construction of housing in the future would generate construction-related vehicle and fugitive dust in the impact area. Construction of the proposed project would temporarily add minor emissions of air pollutants in the immediate vicinity of the proposed project; however, construction of the proposed project would have the potential to only slightly contribute to cumulative air quality impacts. Timing of construction of the proposed project in relation to these other anticipated projects is not known; if they do not occur at the same time, there would not be an additive, or cumulative, impact.

Once in operation, the vadose zone wellfield system would result in little to no additional air quality impacts. Existing electrical power would be used to operate the new wells. No generators would be used that would result in additional air pollutant emissions.

The proposed project's use of electricity would result in gaseous exhaust emissions (including greenhouse gases) that would add cumulatively to pollutants emitted from other natural and human-caused sources into the atmosphere. The relatively minute quantities of pollutants released during construction and operation of the vadose zone wellfield would have a negligible cumulative effect on local air quality or global processes that lead to climate change. Although not quantifiable, use of the recovered water could result in a net reduction in the amount of greenhouse gases generated, depending upon what alternative water sources would have been developed in lieu of the recharged recovered reclaimed water.

B. Geology

1. Affected Environment

The project area is located within the Basin and Range Physiographic Province, which is characterized by a series of mountain ranges with intervening basins. The range in the general vicinity of the project area is comprised mainly of Proterozoic metamorphic, and igneous rocks. The aquifers are formed of volcanic and carbonate rocks, and unconsolidated to consolidated basin-fill deposits. The project area falls within the West Salt River Valley (WSRV) sub-basin, which is one of seven groundwater sub-basins that make up the Phoenix Active Management Area (AMA). This sub-basin covers approximately 1,326 square miles (W. Hipke, personal communication, December 1, 2011). It consists of a broad, gently-sloping alluvial plain surrounded by hills and low elevation mountains. The depth to bedrock extends over 10,000 feet beneath the Luke Air Force Base area.

The alluvium is made up of three quaternary sedimentary deposits that are nearly 1,200 feet deep, containing deposits of gypsum and calcite. The upper alluvial unit is made up of relatively coarse grained unconsolidated materials, which extend about 800 feet below ground surface (bgs). The middle fine grain unit consists of finer grain material extending to a depth of about 1,050 feet bgs. The lower alluvial unit consists mostly of consolidated, relatively coarse grained deposits (Surprise 2008).

Depths to groundwater vary widely within the sub-basin, with shallower levels being found south of Interstate 10 along the Salt and Gila River drainage. Ground water withdrawals within the WSRV sub-basin exceeded recharge by almost 2.6 million acre-feet from 1990 to 2002 (Rascona 2005). A regional groundwater depression has formed east of the White Tank Mountains in the vicinity of Sun City and Litchfield Park, with associated groundwater level declines of more than 300 feet occurring in the area of Luke Air Force Base (AFB). By 1991 this, in turn, resulted in surface subsidence of more than 18 feet (ADWR 2011). Southeast of Luke AFB, a salt body is located about 880 feet bgs. Extending over 6,000 feet bgs, this salt body locally affects groundwater salinity.

2. Environmental Consequences

a. Proposed Action – It is anticipated that recharge resulting from the proposed project would better utilize the excess reclaimed water being generated by the City's WRF by recharging to the underlying aquifer. Within the AOI any reduction in ground water consumption as a result of recovering and using reclaimed water, combined with local aquifer recharge, may help somewhat to mitigate the rate and severity of historic and ongoing subsidence in the general area. The proposed project is not anticipated to impact, or be impacted by, the salt body, as it is located too deep and far away from the wellfield (J. Bodenchuk, personal communication, December 1, 2011).

b. No Action Alternative – The City would continue constructing the vadose zone recharge wells in question, but over a longer period of time (5 years). The absence of recharging reclaimed water to the underlying aquifer would result in the City's dependence on ground water for a longer period of time, which could contribute to ongoing subsidence.

3. Cumulative Impacts – Development of the area surrounding the proposed wellfield into low density and suburban residential areas (agriculture-related residences or one resident per acre or less), and employment centers would not result in impacts to the local geology. Long term recharge to the aquifer could lessen the potential for local subsidence in the area which, in turn, would lessen the chance of structural damage.

C. Water Resources

1. Existing Conditions

a. Ground water – As mentioned above, the project area is located within the WSRV sub-basin. Ground water is found almost evenly among the upper, middle and lower basin fill; however, ground water pumped and served within the boundaries of the City's water service area is pumped mostly from the middle alluvial unit (Rascona 2005). The generalized flow direction of the ground water is towards the northwest (ADWR 2010). Natural groundwater recharge occurs along stream channels and from mountain front recharge. Additionally, ground water also infiltrates the WSRV sub-basin from the Lake Pleasant, northern Hassayampa, and East Salt River Valley sub-basins. Historically, groundwater also entered the WSRV sub-basin from the Maricopa-Stanfield sub-basin to the east in the Pinal AMA. Other contributing sources of water to this sub-basin include recharged agricultural irrigation water from nearby farms, and effluent discharged from the City of Phoenix' 23rd and 91st Avenue wastewater treatment plants. Several reclaimed water and Central Arizona Project (CAP) water recharge facilities in the WSRV also contribute substantial volumes of water to the regional aquifer.

There are 12 water service providers that operate within the Surprise water service area. All the providers deliver ground water. Approximately 7,000 AF of ground water are withdrawn annually by the City of Surprise and at least another 8,000 AF of ground water are pumped by the adjacent water providers for deliver to water users within the Surprise water

service area. There also are some residents within the water service area who obtain their potable water from private wells.

Surprise has entitlement to 10,249 AFA of CAP water from the Colorado River. For the past couple years, Surprise has been recharging its entire CAP water entitlement at underground storage facilities located within the WSRV sub-basin, which are owned and managed by the Central Arizona Water Conservation District, to accrue long-term CAP water storage credits for future use (L. Lambert, personal communication, November 15, 2011).

The reclaimed water to be recharged is rated as A+ and, as indicated by the monitoring that has been conducted pursuant to the City's existing APP related to the City's ongoing basin and vadose zone well recharge efforts, there have been no adverse effects on underlying native aquifer chemistry (L. Lambert, personal communication, November 29, 2011).

Table 3-3 indicates the water quality for selected constituents of ground water served within the City's water service area, taken from the 2010 Annual Water Quality Reports, and available information regarding Class A+ reclaimed water from the WRF provided by the City.

b. Surface Water – The major sources of surface water in the Phoenix AMA include the Gila River and its four principal tributaries—the Salt, Verde, Agua Fria, and Hassayampa rivers. The Agua Fria River channel, which is located about 2-1/2 miles east of the project area, is ephemeral south of New Waddell Dam, flowing generally in a southerly direction only during storm events or when releases are made at New Waddell Dam. The project area consists mostly of irrigated fields and housing developments; there are no longer any desert washes or ephemeral streams remaining within the general project vicinity other than the Agua Fria River channel.

Table 3-3. Water Quality of Local Ground Water & City's Class A+ Reclaimed Water

Parameter	Standard	Units	City of Surprise 2010 Water Quality*	AZ American Water Co. 2010 Water Quality Rpt	Class A+ Reclaimed Water* (mg/l)	
			mg/l (highest detected unless range is given)		Mean	Min-Max
Arsenic	0.010[1] (MCL)	mg/l	0.010	0.008	0.002175	0.0007 – 0.002
Barium	2 (MCL)	mg/l	0.00002	0.122	0.0225	0.01 – 0.03
Chromium	0.10 (MCL)	mg/l	0.037	0.055	0.00475	0.004 – 0.005
Fluoride	4.0 (MCL)	mg/l	2.55	0.4	0.83	0.77 – 0.91
Nitrate (as Nitrogen)	10 (MCL)	mg/l	7.51	6.54	3.003	1.88 – 4.45
Selenium	0.050 (MCL)	mg/l	0.0062	0.004	0.002	0.002 – 0.002
Chloride	250 (SMCL)	mg/l		96-108		
Iron	0.3 (SMCL)	mg/l	.05			
Magnesium	No STD	mg/l	3 – 36	2 – 26		
Manganese	0.05 (SMCL)	mg/l		< 0.01 – 0.019		
Sodium	No STD	mg/l	75 – 106	75 – 95		
Sulfate	250 (SMCL)	mg/l		216 – 248		
TDS	500 (SMCL)	mg/l	718			
Zinc	5 (SMCL)	mg/l				
Copper	1.30 (AL)	mg/l	.36	.032		
Gross Alpha	15 (MCL)	pCi/l	5.6	4		
Radium 226	5 (MCL)	pCi/l	1.10	0.6		
pH	6.5 to 8.5 (SMCL)	STU	7.93 – 8.93	7.4 – 8.9		

[1] Prior to January 23, 2006, MCL for arsenic was 50 μg/l.
AL – Action Level.
MCL – Maximum Contaminant Level (EPA Primary Standard).
NR – Not Reported.
SMCL – Secondary MCL (taste and aesthetics).
STD – Standard.
STU – Standard Testing Units.
TDS – Total Dissolved Solids.
mg/l – milligrams per liter equivalent to parts per million.
pCi/l – picocuries per liter.
Sources: AAWC 2010; *L. Lambert, personal communication, November 23, 2011

2. Environmental Consequences

a. Proposed Action. Under the proposed action, 15 vadose zone wells would be constructed and put into service by early 2013. Surprise would have the capacity to recharge up to 6,049 AFA using the newly completed wells, for a total capacity of 8,049 AFA using all 20 wells. This is essentially the maximum annual storage allowed by the USF permit (8,066 AFA). Over time, infiltration rates typically decline; contingency wells could be constructed and/or the existing recharge basins could also be used in combination, so long as the 8,066 AFA limit is not exceeded. The total design capacity of the facility (maximum amount that can be recharged over the 20-year life of the project) is 163,320 AF. The projected maximum AOI, within which a one-foot or more rise in the groundwater level would occur over the life of the project, extends from the proposed wellfield out about 6.9 miles in any direction (Figure 3). The water would tend to "mound," with the maximum rise of 165 feet occurring directly underneath the wellfield. The model used to estimate this rise assumed ambient groundwater levels would continue to rise at the same rate experienced between 1983 and 2003. This assumption provides a conservative estimate; population growth projections indicate there will be greater water demands into the future which would result in increased ground water pumping and thus, declining ground water levels.

Recharge operations could temporarily impact wells near the recharge facilities. As groundwater levels rise, wells within the impact area could draw in more fines, resulting in turbid or muddy pumped water. This would depend upon the well's distance from the recharge facility, the well's screen length and depth, the size of the pump in the well, and whether or not the well was constructed with a gravel pack around the well screen. Depending upon the purpose(s) for which the water is being used and the length of time it takes for the water to clear up, there could be some minor damage to property and/or inconvenience to those using the well water, especially if it is used for domestic purposes. These temporary impacts would be more likely to occur with small capacity wells rather than large production (irrigation) wells. According to ADWR well records, there are about 40 irrigation wells and 12 domestic wells within one mile of the project. For the nearby domestic wells, recharged water may travel down the outside of existing well casings, causing the casing to collapse. Monitoring required by the USF permit, should alert the wellfield operator in sufficient time to modify the recharge operations so that adverse impacts to nearby domestic wells can be avoided.

The reclaimed water to be recharged will be of the highest quality produced by a reclamation facility. As already mentioned above, no adverse effect on the underlying aquifer water quality has occurred based upon monitoring that has taken place over the past 5 years pursuant to the City's APP. Using the vadose zone wells to recharge the reclaimed water would allow a certain amount of soil aquifer treatment to occur to the water as it percolates down through the aquifer, depending upon a variety of variables including, but not limited to the characteristics and depth of the soil layers, infiltration rate of the recharged water, and length of time the water is retained in the aquifer (Aertgeerts and Angelakis 2003).

As part of its constructed USF permitting process, ADWR requires permit applicants to show that no unreasonable harm will occur to other land and water users within the AOI from the proposed recharge project. The USF permit establishes a Monitoring Plan that

Surprise must implement, which will indicate if/when groundwater levels of three monitoring wells rise to within 20 feet bgs.

Water quality requirements for the USF are governed by the APP issued by Arizona Department of Environmental Quality (ADEQ) for the facility. Two of the monitoring wells identified in the USF permit are identified in the APP as the "Point of Compliance" (POC), and are to be used for all the water quality-related sampling/monitoring (Figure 2). Because the locations of these monitoring wells are in such close proximity to the recharge activities, any potential quality or quantity concerns associated with the recharge facility or its operations should be detected early enough to prevent serious damage to the recharge facilities, structures or equipment within the project area, or the underlying ground water. The monitoring requirements of the APP, related to the vadose zone wellfield, include but are not limited to the following:

- Water flow to the vadose zone wells;
- Quality of water discharged from the WWTP (including sampling and testing for almost 40 parameters);
- Static water levels of the monitoring wells; and
- Quality of the ground water at the monitoring wells (including sampling and testing for the 40 parameters identified to be tested in the WWTP discharge as well as 13 additional parameters)

The APP establishes "alert levels" (AL) and "discharge limits (DL) for each constituent/parameter that must be monitored. These requirements provide for early detection of any changes to ground water quality that could result in violations of water quality standards. Similarly for water quantity aspects, the USF establishes its own "alert level" (AL) regarding ground water elevational rise, as well as an "operation prohibition level" (OPL) above which water within the designated monitoring well cannot rise. These two requirements ensure the ground water table will not rise above pre-established levels, to prevent damage to other property within the AOI.

No impacts to known underground contaminated sites are anticipated to occur as a result of recharging up to 8,049 AFA at the proposed vadose zone wellfield. ADEQ's records indicate there were two leaking underground storage tanks within a little over a mile radius of the project area; both sites were remediated and the cases have been closed (ADEQ 2011b). ADEQ's records also indicate there are six "Brownfields"3 sites within a 2-mile radius of the proposed wellfield. Three of these sites have been cleaned up and their cases closed. All three "active" sites involve soil contamination (ADEQ 2011a); the contamination is close to the ground surface and would not be affected by the recharge project as the monitoring required by the USF permit would ensure the ground water table does not reach within 15 feet of the ground surface. A former EPA Superfund[4] site is located on the Luke Air Force Base (AFB), which is located approximately four to five miles south and west of the proposed wellfield. Placed on EPA's National Priorities List on August 30, 1990, the site consisted of several contaminated

3 The Brownfields Site definition is found in Public Law 107-118 (H.R. 2869) - "Small Business Liability Relief and Brownfields Revitalization Act" signed into law January 11, 2002. Basically, it means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

4 Superfund sites are the Nation's worst hazardous toxic waste sites, as determined by EPA.

sites within the Luke AFB complex. Testing performed before and during clean-up at the various locations detected contamination of surface soils, and both surface and ground water, as deep as 160 feet bgs, depending upon the location and type of site (EPA 2002). The Luke AFB Superfund site was cleaned up and formally delisted in 2002; annual inspections and reporting requirements continue to be carried out pursuant to a 2002 Record of Decision (ADEQ 2011c). The proposed project would not change the ground water elevation in the vicinity of Luke AFB such that any remediated site would be affected.

The following measures would be undertaken as part of the project, to reduce potential adverse impacts to water resources.

1. An Arizona Pollutant Discharge Elimination System (AZPDES) Storm Water Pollution Prevention permit for construction would be obtained by the Contractor, who would prepare and implement a Storm Water Pollution Prevention Permit plan to reduce the introduction of pollutants into waters of the U.S.

2. Surprise would comply with all monitoring and reporting requirements of its ADWR USF and ADEQ APP permits, to ensure any impacts from the proposed recharge does not cause any water quantity and quality concerns.

b. No Action Alternative – Under the No Action alternative, Surprise would continue to construct additional vadose zone wells, but at a slower pace. It is envisioned that in the near term, Surprise would continue to recharge up to 2,000 AFA using the existing vadose zone wells, and would be able to construct the additional 15 vadose zone wells over the next 5 years.

c. Cumulative Impacts – There currently are 10 USFs located within the WSRV that recharge water, either CAP or reclaimed water or both, with a combined maximum permitted volume of approximately 230,000 AFA. Three of these facilities are located within the proposed project's AOI: El Mirage (2,016 AFA of reclaimed water); Glendale (7,841 AFA of reclaimed water); and New River/Agua Fria Underground Storage Project (50,000 AFA of both CAP and reclaimed water). The contributions of these recharge projects, some of which have been in operation since 1993, were included in the City's analysis of the AOI.

D. Cultural Resources

1. Existing Conditions – There is a 3- to 5-foot high earthen berm surrounding the 10-acre parcel identified as the wellfield; this parcel has been heavily disturbed through grading and well site construction. The berm appears to have been mechanically pushed from the center of the field to form the mound surrounding the wellfield itself. In addition, there are five existing wells, a modern canal ditch to the west and a large retention basin in the center-west portion of the project area. According to Lee Lambert, City of Surprise project manager, the area was previously a citrus orchard prior to construction of the wellfield (Lambert 2011). A Class I survey (literature search) revealed three previous cultural resource surveys occurred within the surrounding area in 2003-2004. One previously recorded cultural resource site, a

historic farm that was determined not to be eligible for listing on the National Register of Historic Places, was found in the surrounding area.

2. Environmental Consequences

a. Proposed Action – A Class III (intensive on-the-ground) cultural resource survey was completed on October 24, 2011 by Reclamation Archaeologist, Dave Gifford. The entire field was surveyed (10 acres) rather than individual well plots to enable the project proponent flexibility to place wells where needed. Ground visibility was 100% but the entire project area has been altered from its natural state. No cultural resources were observed. Excavation of the trench to install the pipeline, and installation of the vadose zone wells are not anticipated to impact any cultural resources. Operation of the recharge project would not entail additional land disturbance. There would be no impacts to cultural resources as a result of constructing and operating the proposed project.

b. No Action Alternative - Under the No Action Alternative, no land disturbing activities would occur in the project area as a result of the proposed project; therefore, any previously undiscovered cultural resources that might be located beneath the surface would remain intact and undetected. However, previous studies have indicated it is highly unlikely that any are present in the area.

c. Cumulative Impacts – Because the proposed project is not anticipated to result in any impacts to cultural resources, it would not add to any cumulative impact resulting from future urban development.

E. Resources Not Discussed in Detail

The following resource topics, which are typically included in NEPA documents, are not discussed in detail in this EA: Biological resources, land use and recreation, and socioeconomic resource. The proposed wellfield site previously was irrigated farm land (citrus grove), which was later leveled and bermed. It currently is devoid of vegetation, and no impacts to vegetation or habitat would occur as a result of implementing the proposed action. Further, no changes to land use or ownership (including recreation) would occur as a result of the proposed action; the proposed wellfield is located within a larger parcel of land already owned by Surprise upon which wastewater treatment facilities and recharge basins are already located. Any reclaimed water that has been delivered and used to irrigate park land or golf courses will continue to be delivered, with or without the construction and operation of the additional vadose zone wells. There may be some minor increase in temporary construction-related employment; however, it would be for only a brief period of time. Operation of the additional wells is not anticipated to result in additional staff requirements. The accumulation of recharged water credits will assist in reaching and maintaining an adequate water supply as Surprise continues to develop and expand; however, it would be too speculative to attempt to quantify any potential savings that may result from construction and operation of the vadose zone recharge wellfield project as compared to acquiring and developing new water supply sources.

IV. ENVIRONMENTAL MITIGATION MEASURES

Following are specific mitigation measures that will be implemented by Surprise as an integral part of this project.

1. Monitoring and reporting requirements included in both Surprise's USF Permit from ADWR and APP Permit from ADEQ, addressing water quality and quantity issues will be implemented. Results from these monitoring and sampling efforts will be reported on the frequency identified in the permit; additional steps are identified to be taken if established limits are exceeded.

2. Standard specification clauses included in all City of Surprise contracts require the contractor to comply with air quality regulations; dust abatement measures will be implemented during construction and operation of the vadose zone wells, to minimize air pollution and dust nuisance.

3. If previously undiscovered cultural resources are identified during excavation activities, all work will cease until the discovery can be evaluated by a Reclamation archaeologist.

4. Standard specification clauses included in all City of Surprise contracts limit work hours to 5:00 a.m. and 4:30 p.m. unless otherwise approved; construction activities will be restricted to daylight hours to the degree practicable.

6. Areas disturbed by construction activities that are not needed for permanent facilities will be stabilized in compliance with Arizona Pollutant Discharge Elimination System stormwater pollution prevention plan requirements. .

V. CONSULTATION AND COORDINATION

In preparing its permit to ADWR for a constructed USF facility, Surprise coordinated with the ADWR and ADEQ. ADWR published a notice in the Arizona Business Gazette, which ran for two consecutive weeks, on January 14 and 21, 2010, after which there was a 15-day objection period. No objections to issuance of the permit were filed.

VI. ENVIRONMENTAL LAWS AND DIRECTIVES CONSIDERED

A. National Environmental Policy Act. This EA has been prepared in accordance with the requirements of NEPA, Interior's Departmental Manual, and Departmental regulations implementing NEPA found at 43 CFR Part 46 (Vol. 73, 61314-61323). This EA is being issued with a Finding of No Significant Impact (FONSI) determination, and is being made available on Reclamation's Phoenix Area Office website.

B. Clean Water Act, as amended. Surprise and its contractor will acquire and abide by conditions of any and all applicable Arizona regulations implementing the Clean Water Act, including but not limited to an AZPDES stormwater permit for construction activities disturbing an acre or more of land.

C. Clean Air Act, as amended. Construction-related activities will result in minor temporary air quality degradation. State or local grading/excavation permits will need to be acquired for such activities. Compliance with these permits will ensure NAAQS limits are not exceeded and no significant air quality impacts will occur. Long-term operation of the recharge wells and wellfield are not expected to degrade air quality to any measurable extent; only short distance vehicular traffic associated with routine operation and maintenance activities would occur. Best management practices for controlling dust will be employed for both construction-related and maintenance activities. Any applicable grading and/or dust control permits will be acquired as appropriate.

D. Endangered Species Act of 1973, as amended. No species that are federally listed as threatened or endangered, or proposed for listing are found within the project area. There also is no designated critical habitat that would be impacted by the proposed project. California Least Terns (*Sterna antillarum browni*) were documented nesting at recharge facilities about 6 miles away from the project area in 2009. No other nesting has been documented in Arizona and the project area does not contain suitable habitat for the California least tern.

E. Fish and Wildlife Coordination Act. The proposed action does not constitute a Federal water resource project that impounds, diverts or otherwise modifies a stream or other natural body of water; therefore this Act is not applicable.

F. National Historic Preservation Act of 1966, as amended. Based upon Class I and Class III studies conducted within the project area, adverse impacts to cultural resources are not expected to result from this proposed project. The Arizona State Historic Preservation Officer has concurred with this determination.

G. Wild and Scenic Rivers Act of 1968. There are no rivers designated or proposed for designation as wild and scenic within or near the project area.

H. Wilderness Act of 1964, as amended. There are no areas designated or proposed for designation as wilderness areas within or near the project area.

I. Executive Order 11990, Protection of Wetlands. There are no wetlands found within the project area.

J. Executive Order 11998, Floodplain Management. The project is located outside the 100-year floodplain. No further action is required with regard to this Executive Order.

K. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. The area being used for this project is owned by Surprise. No minority or low-income populations will be adversely impacted by this project.

L. Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. The project will not take migratory birds, their nests, eggs, or parts because the project would not take migratory birds and the project area does not contain suitable nesting habitat.

VII. LIST OF PREPARERS

The following individuals prepared or assisted in the preparation of this EA:

Reclamation

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