Basic Remediation
COMPANY

TECHNICAL MEMORANDUM

To: Greg Lovato, P.E., Nevada Division of Environmental Protection (NDEP)

From: Ranajit Sahu, Ph.D., C.E.M. (BRC)

cc: Stephen J. Cullen, P.G., C.E.M. (DBS&A)
John J. Dodge, P.G. (DBS&A)

Date: September 23, 2010

Subject: **Technical Memorandum – Proposed Methodology to Compare Groundwater Data from On-Site Wells and Upgradient Wells BMI Common Areas (Eastside-Main and Eastside-Hook Area) Clark County, Nevada**

INTRODUCTION AND OBJECTIVES

In a project meeting on July 27, 2010, NDEP requested a technical memorandum to describe the proposed approach that Basic Remediation Company (BRC) will use to statistically compare detected on-site indicator parameter (IP) groundwater concentrations in Shallow Zone wells with IP concentrations detected in upgradient Shallow Zone wells. BRC has provided NDEP, in a separate Technical Memorandum (BRC, 2010), a revised list of IPs for the Shallow Zone (as well as the other water bearing zones) that, upon finalization, will be used for a variety of assessments including monitoring and/or development of a Remedial Alternatives Study (RAS). This memorandum deals specifically with how to make appropriate upgradient versus on-site well data comparisons in the Shallow Zone (the only water-bearing zone for which such upgradient data are available, based on location and geologic considerations) that can be used to help guide remedial decision-making for the Site by showing the influence of upgradient locations into the site and also by quantifying, where possible, the extent of impacts due to off-site upgradient sources.

This technical memorandum defines:

- Upgradient wells for the Eastside-Hook area;
- On-site/upgradient well groups in the Eastside-Main and Eastside-Hook areas; and
- The statistical methodology for comparison of groundwater IP concentrations in on-site/upgradient well groups.

UPGRADIENT WELLS - EASTSIDE HOOK AREA

BRC prepared a report entitled *Revised Upgradient Wells Report*, dated May 14, 2010 (upgradient wells report) to identify Shallow Zone wells upgradient of the Eastside-Main area (Figure 1) (DBS&A, 2010b). NDEP approved this submittal in correspondence to BRC dated August 26, 2010.

However, this document did not define the upgradient wells for the Eastside-Hook area Shallow Zone. To do so, the BRC numerical groundwater flow model (DBS&A, 2009) was used to identify groundwater flow path lines (particle tracks) across the Site. Particle tracks trace the path of groundwater advection downgradient and perpendicular to groundwater elevation contours over a selected period of time. Using the Current Scenario of the flow model, particles were "released" from candidate upgradient wells and the tracks were traced to delineate the flow paths across the Site (Figure 2). Particles were simultaneously released from each flow model layer that the candidate well screen penetrates. A 100-year time period was used in the particle tracking.

Upgradient wells were identified using the particle tracks (groundwater flow paths) and a consideration of the distribution of impacted wells across the Site (IP plume shape). IP plume shape was considered because it can vary from groundwater flow paths due to changing flow direction over time, varying recharge, dispersion, variations in hydraulic conductivity, and other hydrogeologic factors.

As shown in Figure 2, flow path lines from several wells are directed into the operating extraction wells of the AMPAC Athens Road Extraction Area, the AMPAC Athens Pen Extraction Area, and the AMPAC in-situ bioremediation system extraction wells near the Eastside-Hook area. BRC notes, however, that at times before the extraction systems began operation, unremediated impacted groundwater flow tracked across the Eastside-Hook area. Eastside-Hook area impacts to groundwater in part originated upgradient before the extraction systems were activated. Therefore, BRC will utilize data from those wells from time periods prior to the initiation of extractions.

Current Shallow Zone groundwater flow maps (Figures 3 and 4) and IP isocontour maps (BRC, 2010) were also used in the selection of upgradient wells. Active extraction wells in the area were not considered as upgradient well candidates.

Using flow maps, particle tracks, and IP plume maps, the following upgradient wells are identified for the Eastside-Hook area (Figure 2):

- TWD1-17
- MW-A-J
- TWI
- TWC-15
- MW-K1
- PC-123
- TWE-15
- L635
- HMW-16
- HMW-15
- PC-103
- PC-98R
- MW-K5
- PC-53
- PC-1
- PC-2
- MW-S
- PC-104
- HMW-14
- HMW-13

UPGRADIENT/ON-SITE WELL PAIR SELECTION FOR THE EASTSIDE-MAIN AND EASTSIDE-HOOK AREAS

As detailed below, groundwater data from upgradient wells will be statistically compared to data from on-site downgradient wells to help evaluate the source of on-site impacts. The first step in the statistical analysis is to identify pairs or sets of wells that can be compared. The well sets consist of on-site wells grouped with appropriate upgradient wells.

Particle tracks, groundwater flow maps, and IP plume shape analysis discussed above were used to pair on-site wells in the Eastside-Hook area and the Eastside-Main area with upgradient wells or upgradient groups of wells. Tables 1 and 2 present the selected Shallow Zone upgradient/downgradient well sets for the Eastside-Main area and the Eastside-Hook area, respectively.

Upgradient/downgradient statistical analysis for the Eastside-Hook and Eastside-Main areas will be completed separately. As discussed in the July 27, 2010 project meeting with NDEP, based on a preliminary review of IP plume shapes and groundwater flow direction, there may be a need to further subdivide the Eastside-Main area into additional subareas that consist of relatively distinct groundwater impact influence zones. Thus, the following preliminary subareas are proposed for separate statistical analysis (Figure 1):

- Eastside-Hook area;
- Eastside-Main areas to the east of the intersection of East Lake Mead Boulevard and Boulder Highway (Eastside-Main East);
- Eastside-Main areas to the west of the intersection of East Lake Mead Boulevard and Boulder Highway (Eastside-Main West); and
- Eastside-Main well AA-UW-6 area.

PROPOSED STATISTICAL METHODOLOGY

Guidance from the U.S. Environmental Protection Agency (U.S. EPA) presents a systematic methodology for comparing detected analyte concentrations between two monitoring wells (U.S. EPA, 1992). Gibbons et al. (2009) clarifies and summarizes the U.S. EPA methodology. The following description of the methodology to be used for the Eastside-Hook and Eastside-Main statistical analyses is taken primarily from these two sources.

1. For each constituent, the appropriate regulatory criterion (U.S. EPA maximum contaminant level [MCL] or NDEP basic comparison level [BCL]) will be identified. In cases where both an MCL and BCL exist for an individual constituent and are not equal, the lower of the two will be used.

2. For each constituent that has a concentration in the correlated upgradient well that is higher than the regulatory criterion, the upgradient comparison standard will be set to the 95% upper prediction limit (UPL), which is computed from all available data collected from the upgradient well (Gibbons et al., 2009). The upgradient well chemical data will be first screened for outliers and then tested for normality and lognormality in order to determine the appropriate prediction limit to use as a comparator.

    a. If the test of normality cannot be rejected (e.g., at the 95% confidence level), the comparator upgradient well concentration will identified as equal to the 95% confidence normal prediction limit.

    b. If the test of normality is rejected but the test of log normality cannot be rejected, the comparator upgradient well concentration will be identified as equal to the 95% confidence lognormal prediction limit.

    c. If the data are neither normally nor lognormally distributed, or the detection frequency is less than 50%, the comparator upgradient well concentration will be the nonparametric prediction limit, which is computed as a particular order statistic (e.g., ranked observation) of the upgradient well concentration (i.e., the maximum). If the detection frequency is zero, the comparator upgradient well concentration will be identified as equal to the appropriate quantification limit (QL) for that constituent.

3. If the upgradient well concentration is greater than the regulatory criterion or if there is no criterion or standard, then comparisons will be made to the upgradient well prediction limit. If the regulatory criterion is greater than the upgradient well concentration, then the appropriate confidence limit will be compared to the regulatory criterion. If no upgradient well concentration is detected, then the upgradient well concentration used for comparison will be assumed to be the QL. If the regulatory criterion is lower than the QL, then the regulatory criterion used for comparison will be set to the QL.

4. The number of sample results used will depend on whether the comparison is to the upgradient well concentration or to the regulatory criterion and whether comparisons are made at individual locations or by pooling samples within an impacted area. As discussed by Gibbons et al. (2009),

    a. If the comparison is being made to upgradient wells, a minimum of one sample result from each upgradient well will be used in the comparison.

    b. If the comparison is to a regulatory criterion and evaluation is required for a single location, a minimum of four independent sample results from that sampling location will be used in the analysis.

    c. If the comparison is to a regulatory criterion for a wider impacted area, a minimum of one sample from each of four sampling locations within the impacted area will be used for the analysis.

    d. If there are fewer than four sampling locations within a given defined impacted area, then the total number of sample results from the impacted area must be four or more (e.g., two sampling locations, each with two independent samples).

5. If the comparison is to a regulatory criterion or standard, the 95% lower confidence limit (LCL) for the mean of at least four samples from a single impacted location or impacted area will be compared to the regulatory criterion to assess whether a regulatory criterion has been exceeded. Once it has been determined through assessment that an area has been impacted independent of the upgradient condition and that corrective action sampling and monitoring is appropriate, the 95% upper confidence limit (UCL) for the mean of at least four samples from a single impacted location or impacted area will be compared to the regulatory criterion.

6. In the case where the upgradient well prediction limit is larger than the regulatory criterion, one of the following will be done:

    a. For a single measurement obtained from an individual location, this sampled concentration will be compared to the upgradient well prediction limit for the next single sampled concentration from each of the single locations to be evaluated.

    b. For multiple sampled concentrations obtained from a given impacted area, the mean of the sampled concentrations from the wells in the impacted area will be compared to the upgradient well prediction limit for the mean of the site sampled concentrations based on the best-fitting statistical distribution or nonparametric alternative.

7. If the upgradient well UPL and the regulatory criterion are similar, it may be possible for the downgradient sampled concentration mean to exceed the upgradient well UPL, but the LCL for the downgradient mean may still be less than the regulatory criterion (LCL < Reg < UPL < Mean). In this case, an exceedance will not be declared.

REPORTING

Upon approval by the NDEP of this Technical Memorandum as well as the previously submitted Technical Memorandum on Eastside-Hook IPs (BRC, 2010), BRC will prepare a report presenting the statistical comparison of the selected well pairs. The report will present the results of the analyses and quantify, where possible, the extent of impacts to BRC wells due to upgradient sources. It is possible, based on discussions with the NDEP, that rather than a separate report, the results will be included within the Conceptual Site Model report that is in preparation by BRC.

REFERENCES

Basic Remediation Company (BRC), 2010. *Technical Memorandum – Indicator Parameter Selection, BMI Common Areas (Eastside-Main and Eastside-Hook Area), Clark County, Nevada.* September 21, 2010. (Received and in review with NDEP.)

Basic Remediation Company (BRC) and Environmental Resources Management (ERM). 2010. *2009 Annual Groundwater Monitoring Report – CAMU Baseline, BRC Corrective Action Management Unit (CAMU) Area, Clark County, Nevada.* Prepared for Nevada Division of Environmental Protection, Las Vegas, Nevada. March 2010.

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Responsible CEM for this Project

I hereby certify that I am responsible for the services described in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and, to the best of my knowledge, comply with all applicable federal, state, and local statutes, regulations, and ordinances.

________________________________ September 23, 2010

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BRC Project Manager

Individuals Who Provided Technical Input to this Document

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Figures

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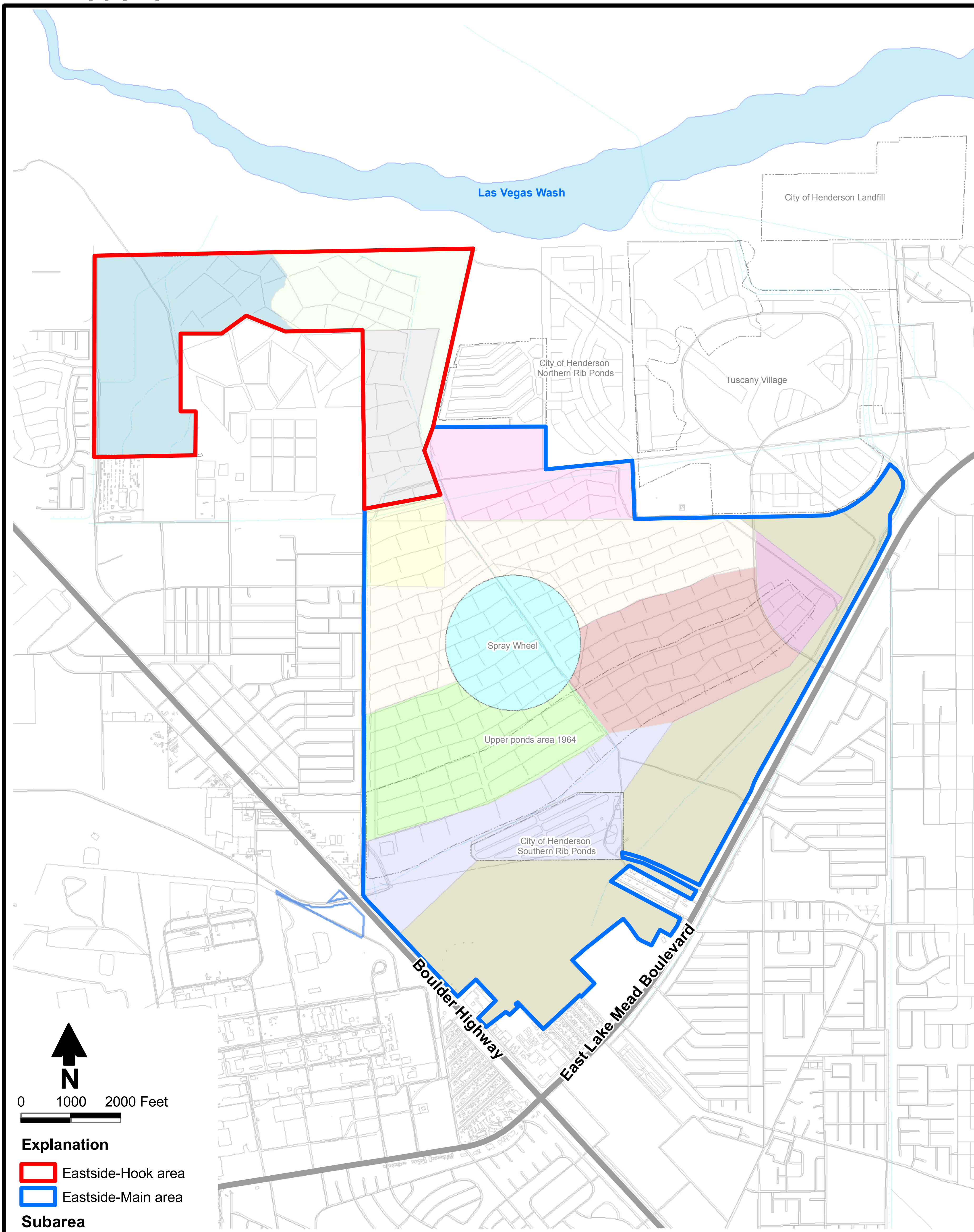

Explanation

- Eastside-Hook area
- Eastside-Main area

Subarea

- First Eight Rows
- Galleria North
- Mohawk
- No Build
- Sunset North Commercial
- Southern RIBs
- Spray Wheel
- TIMET Ponds
- Upper Ponds
- Western Hook
- NFA Areas
- CoH WRF

BMI Common Areas (Eastside)
Henderson, Nevada

FIGURE 1
Conceptual
Site Model Subareas

Daniel B. Stephens & Associates, Inc.
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Prepared by:		Date	
DBS&A	CRS	09-23-10	S:/PROJECTS/BRC/ES09.0281_BRC_WH_AND_PRE-CSM_TASKS/ GIS/MXDS/CHEMISTRY/ LAYER_MODEL/fig01.MXD 019040

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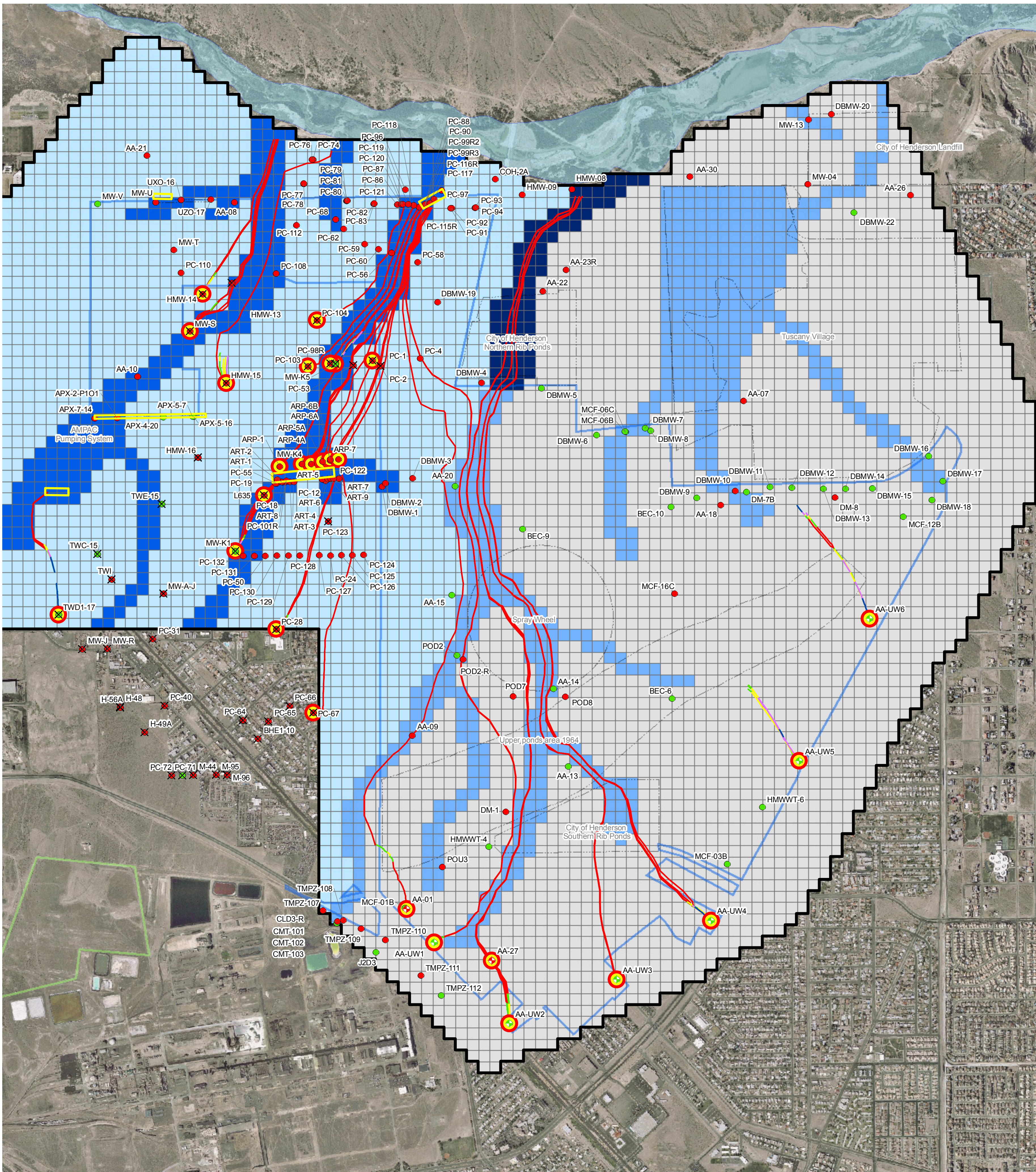

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0 1000 2000 Feet

Explanation

Upgradient well layer 1 – Eastside-Main	Flow model domain
Upgradient well layer 2 – Eastside-Main	Site boundary
Upgradient Wells – Eastside-Hook	Las Vegas Wash
Shallow Zone monitoring well layer 1	Site AOC3 boundary
Shallow Zone monitoring well layer 2	**Horizontal hydraulic conductivity (ft/day)**
Particle release wells	10
Particle tracks layer 1	30
Particle tracks layer 2	100
Particle tracks layer 3	300
Particle tracks layer 4	360
Particle tracks layer 5	
Groundwater extraction well fields	

BMI Common Areas (Eastside)
Henderson, Nevada

FIGURE 2

Particle Tracks from Upgradient Wells

Daniel B. Stephens & Associates, Inc.

Basic Remediation COMPANY

Prepared by: DBS&A CRS

Date 09-23-2010

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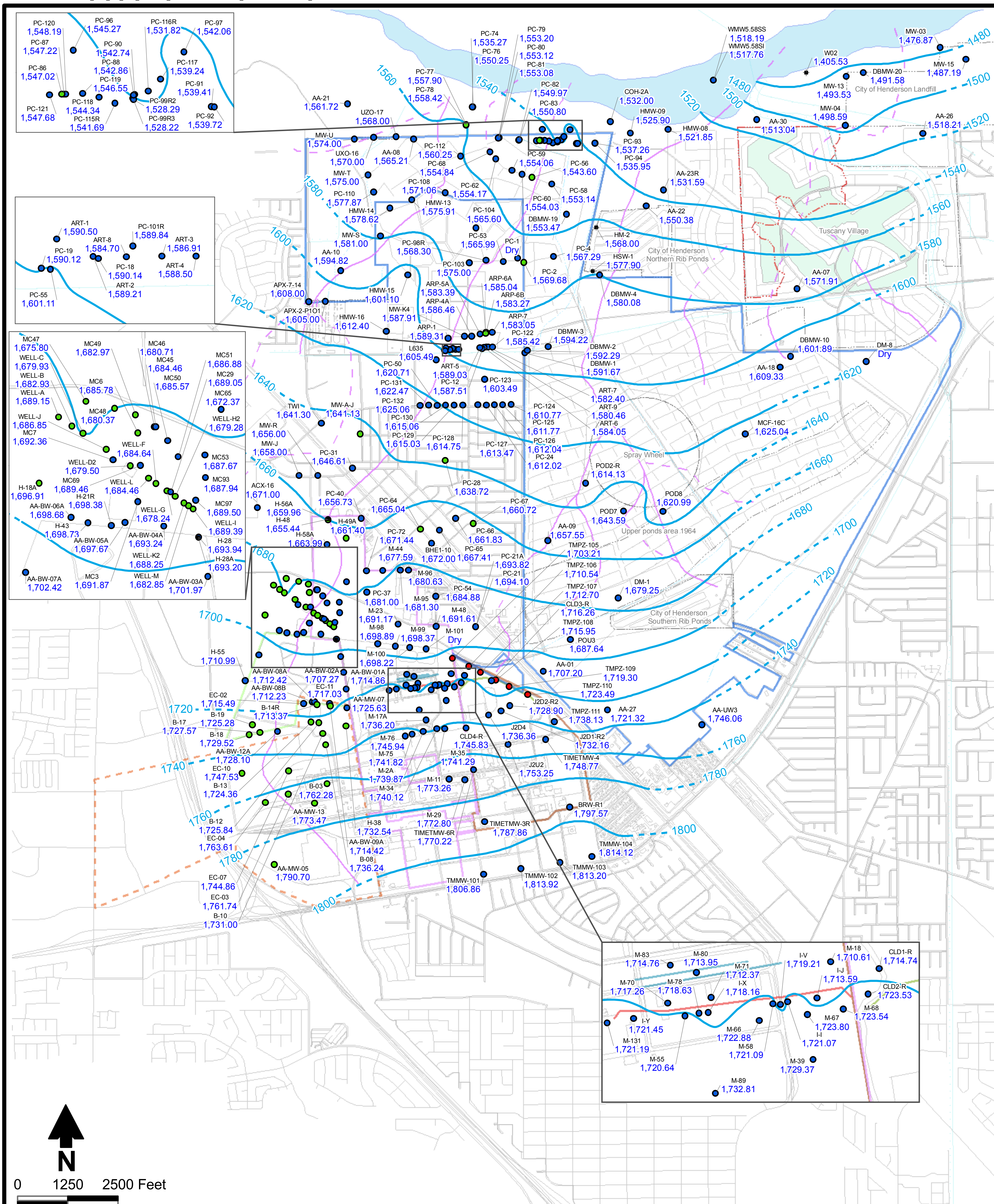

Explanation

Well Date

- 2007
- 2008
- 2009

- Site boundary
- Gravel pit circa 1976. Source: Aerial photograph dated 1976
- TIMET boundary
- Tronox boundary
- POSSM (The Companies)
- Site AOC3 boundary
- Las Vegas Wash
- TIMET proposed slurry wall September 2008
- Tronox groundwater recharge trench
- Tronox slurry wall
- Street
- Potentiometric surface (dashed where inferred)

References:
1. DBS&A, 2010b
2. BRC and ERM, 2010
3. NDEP, 2010
4. TIMET, 2010
5. Tronox, LLC, 2009
6. Tronox, LLC, 2010

BMI Common Areas (Eastside)
Henderson, Nevada

FIGURE 3
Groundwater Potentiometric Surface
Shallow Zone Layer 1

Daniel B. Stephens & Associates, Inc.
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DBS&A CRS	09-23-10	S:/PROJECTS/BRC/ES09.0281_BRC_WH_AND_PRE-CSM_TASKS/GIS/MXDS/CHEMISTRY/LAYER_MODEL/peizometric_LAYER1.MXD 019040

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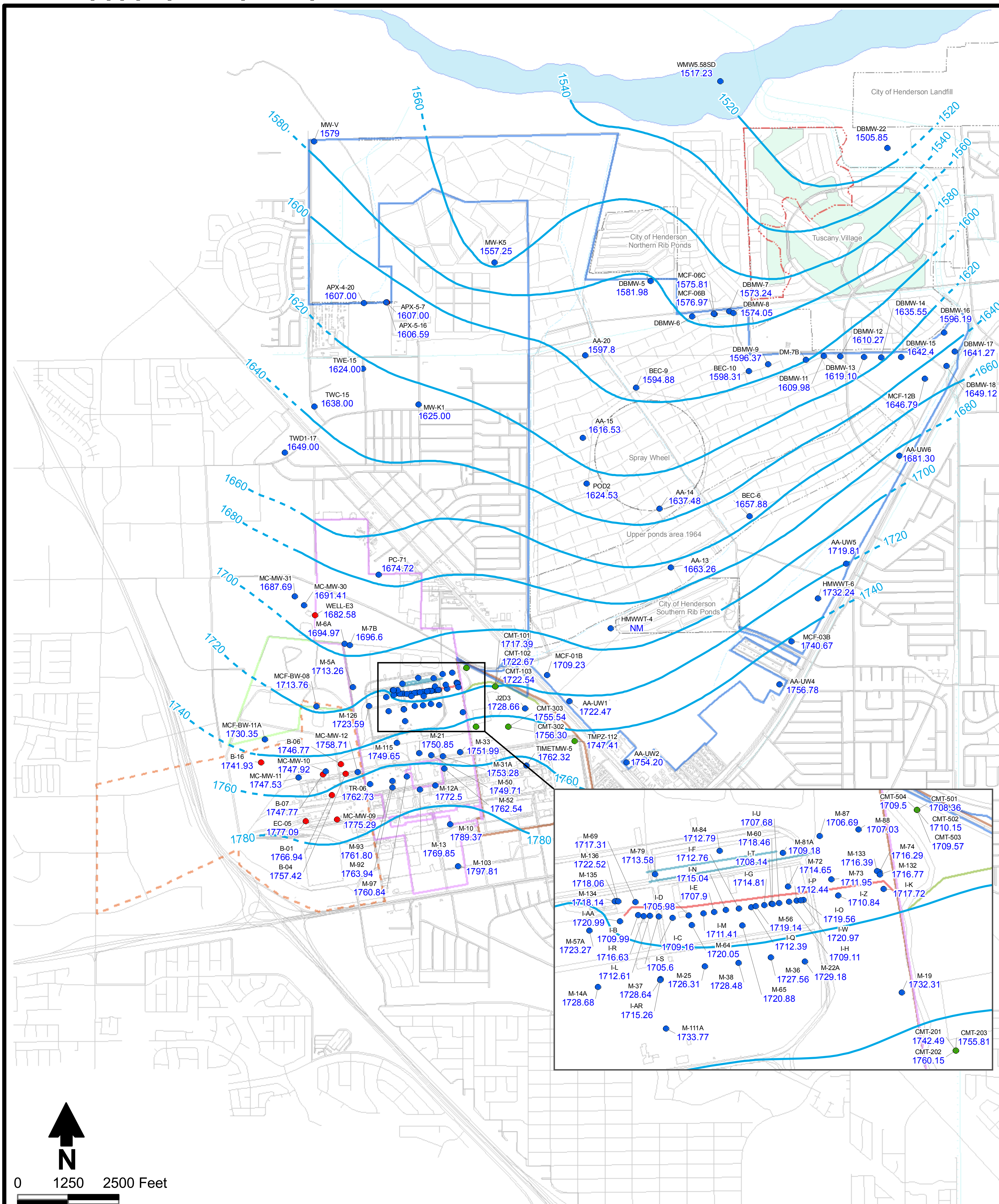

Explanation

Well Date

- 2007
- 2008
- 2009

Site boundary

Gravel pit circa 1976. Source: Aerial photograph dated 1976

TIMET boundary

Tronox boundary

POSSM (The Companies)

Site AOC3 boundary

Las Vegas Wash

TIMET proposed slurry wall September 2008

Tronox groundwater recharge trench

Tronox slurry wall

Street

Potentiometric surface (dashed where inferred)

References:
1. DBS&A, 2010b
2. BRC and ERM, 2010
3. NDEP, 2010
4. TIMET, 2008
5. TIMET, 2010
6. Tronox, LLC, 2009
7. Tronox, LLC, 2010

Note:
1. NM = Not measured (HMWWT-4 obstructed).

BMI Common Areas (Eastside)
Henderson, Nevada

FIGURE 4
Groundwater Potentiometric Surface
Shallow Zone Layer 2

Daniel B. Stephens & Associates, Inc.

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DBS&A	CRS	09-22-10	S:/PROJECTS/BRC/ES09.0281_BRC_WH_AND_PRE-CSM_TASKS/ GIS/MXDS/CHEMISTRY/ LAYER_MODEL/peizometric_LAYER2.MXD 019040

Tables

Table 1. Upgradient/Downgradient Well Sets
Shallow Zone – Eastside-Main Area

Well	Companion Upgradient Wells	Basis
BRC On-Site Wells		
AA-01	TMPZ-110, J2D2-R2, TMPZ-111, TIMETMW-4, J2U2, J2D1-R2, TMPZ-108, CLD3-R, J2D4	Plume shape, groundwater flow and particle tracking
AA-09	AA-01, TMPZ-107 to 110, CLD-3R, CMT-101,2,3, PC-21, PC-21A, J2D4	Plume shape, groundwater flow and particle tracking
AA-13	AA-UW3, AA-UW4, MCF-03B, HMWWT-6	Groundwater flow and particle tracking
AA-18	AA-UW5, AA-UW6	Groundwater flow and particle tracking
AA-20	AA-15, BEC-9, POD2, POD2-R, POD7, AA-14, POD8, PC-123	Plume shape, groundwater flow and particle tracking
AA-27	BRW-R1, TMMW-103, TMMW-104, TMPZ-111	Plume shape, groundwater flow and particle tracking
AA-UW1	J2D3, CMT-303, TMPZ-112, TIMETMW-5, TMPZ-111, TIMETMW-4	Groundwater flow and particle tracking
AA-UW2	BRW-R1, TMMW-103, TMMW-104	Groundwater flow and particle tracking
AA-UW3	—	Located at eastern upgradient boundary
AA-UW4	—	Located at eastern upgradient boundary
AA-UW5	—	Located at eastern upgradient boundary
AA-UW6	—	Located at eastern upgradient boundary
BEC-6	AA-UW4, AA-UW5, MCF-3B, HMWWT-6	Groundwater flow and particle tracking
BEC-9	AA-15, POD2, POD2-R, AA-14, MCF-16C, BEC-6, AA-19	Plume shape, groundwater flow and particle tracking
DBMW-1	PC-28, PC-50, PC-66, PC-67, PC-24, PC-123 to 126	Plume shape, groundwater flow and particle tracking
DBMW-10	AA-UW5, AA-UW6	Groundwater flow and particle tracking
DBMW-11	AA-UW6	Groundwater flow and particle tracking
DBMW-12	AA-UW6	Groundwater flow and particle tracking
DBMW-13	AA-UW6	Groundwater flow and particle tracking
DBMW-14	AA-UW6	Groundwater flow and particle tracking
DBMW-15	AA-UW6, MCF-12B, DBMW-18	Groundwater flow and particle tracking
DBMW-16	DBMW-17, DBMW-18	Groundwater flow and particle tracking
DBMW-17	DBMW-18	Groundwater flow and particle tracking
DBMW-2	PC-28, PC-50, PC-66, PC-67, PC-24, PC-123 to 126	Plume shape, groundwater flow and particle tracking
DBMW-3	PC-28, PC-50, PC-66, PC-67, PC-24, PC-123 to 126	Plume shape, groundwater flow and particle tracking
DBMW-5	AA-20, BEC-9, AA-15, POD2	Groundwater flow and particle tracking
DBMW-7	BEC-10, DBMW-9, BEC-6	Plume shape, groundwater flow and particle tracking
DBMW-8	BEC-10, DBMW-9, BEC-6	Plume shape, groundwater flow and particle tracking
DBMW-9	AA-UW5, BEC-6	Plume shape, groundwater flow and particle tracking
DM-1	HMWWT-4, AA-UW1, AA-27, AA-UW2, POU3, TMPZ-109,110	Plume shape, groundwater flow and particle tracking
HMWWT-6	MCF-03B	Groundwater flow and particle tracking
MCF-01B	J2D3, CMT-302, CMT-303, TIMETMW-5, TMPZ-112	Plume shape, groundwater flow and particle tracking
MCF-03B	AA-UW4	Groundwater flow and particle tracking
MCF-06B	BEC-6, AA-14, DBMW-9, MCF-16C	Plume shape, groundwater flow and particle tracking
MCF-06C	BEC-6, AA-14, DBMW-9	Plume shape, groundwater flow and particle tracking
MCF-12B	AA-UW6	Groundwater flow and particle tracking
MCF-16C	AA-UW5	Groundwater flow and particle tracking
POD2-R	AA-09, MCF-01B, AA-01, AA-UW1, AA-27, POU3, HMWWT-4, DM-1	Groundwater flow and particle tracking
POD8	AA-13, AA-UW3, AA-UW5, AA-27, AA-UW1, HMWWT-4, DM-1	Groundwater flow and particle tracking
POU3	AA-01, TMPZ-108,109,110, CLD3-R	Plume shape, groundwater flow and particle tracking

Table 1. Upgradient/Downgradient Well Sets
Shallow Zone – Eastside-Main Area

Well	Companion Upgradient Wells	Basis
Non-BRC On-Site Wells		
AA-14	AA-13, AA-UW3, AA-UW5, AA-27, AA-UW1, HMWWT-4, DM-1	Groundwater flow and particle tracking
AA-15	AA-09, MCF-01B, AA-01, AA-UW1, AA-27, POU3, HMWWT-4, DM-1	Groundwater flow and particle tracking
BEC-10	AA-UW5, BEC-6	Groundwater flow and particle tracking
DBMW-18	—	Located at eastern upgradient boundary
DBMW-6	BEC-6, AA-14, DBMW-9, MCF-16C	Groundwater flow and particle tracking
DM-7B	AA-UW5, AA-UW6	Groundwater flow and particle tracking
DM-8	AA-UW6	Groundwater flow and particle tracking
HMWWT-4	AA-UW1, AA-27, AA-UW2, POU3, TMPZ-109,110	Plume shape, groundwater flow and particle tracking
POD2	AA-09, MCF-01B, AA-01, AA-UW1, AA-27, POU3, HMWWT-4, DM-1	Groundwater flow and particle tracking
POD7	AA-13, AA-UW3, AA-UW5, AA-27, AA-UW1, HMWWT-4, DM-1	Groundwater flow and particle tracking

— = Not applicable

MCL = U.S. Environmental Protection Agency Maximum Contaminant Level

BCL = Nevada Division of Environmental Protection Basic Comparison Level

ND = Not detected

Table 2. Upgradient/Downgradient Well Sets
Shallow Zone –Eastside-Hook Area

Well	Companion Upgradient Wells	Basis
BRC On-Site Wells		
AA-08	MW-S, HMW-14	Plume shape, groundwater flow and particle tracking
AA-10	APX-2-P1-16	Groundwater flow and particle tracking
DBMW-19	PC-2	Groundwater flow and particle tracking; PC-2 on property line
PC-108	MW-S, HMW-13,14,15	Plume shape, groundwater flow and particle tracking
PC-2	PC-28, PC-24, PC-55	Groundwater flow and particle tracking
PC-4	AA-15, BEC-9, POD2, POD2-R, POD7, AA-14, POD8, AA-20	Groundwater flow and particle tracking
PC-79	MW-S, HMW-13,14,15	Plume shape, groundwater flow and particle tracking
PC-80	MW-S, HMW-13,14,15	Plume shape, groundwater flow and particle tracking
PC-81	MW-S, HMW-13,14,15	Plume shape, groundwater flow and particle tracking
PC-88	PC-104, PC-98R, PC-103, PC-53	Plume shape, groundwater flow and particle tracking
PC-90	PC-104, PC-98R, PC-103, PC-53	Plume shape, groundwater flow and particle tracking
PC-94	PC-104, PC-98R, PC-103, PC-53	Plume shape, groundwater flow and particle tracking
Non-BRC On-Site Wells		
MW-T	PC-110, HMW-14, MW-S, AA-10, HMW-15, HMW-16, TWE-15, TWC-15, TWI, MW-A-J, TWD1-17	Plume shape, groundwater flow and particle tracking
MW-U	MW-T, PC-110, HMW-14, MW-S, AA-10, HMW-15, HMW-16, TWE-15, TWC-15, TWI, MW-A-J, TWD1-17	Plume shape, groundwater flow and particle tracking
MW-V	MW-T, PC-110, HMW-14, MW-S, AA-10, HMW-15, HMW-16, TWE-15, TWC-15, TWI, MW-A-J, TWD1-17	Plume shape, groundwater flow and particle tracking
PC-110	HMW-14, MW-S, AA-10, HMW-15, HMW-16, TWE-15, TWC-15, TWI, MW-A-J, TWD1-17	Plume shape, groundwater flow and particle tracking
PC-112	PC-108, HMW-13 to 16, MW-2, AA-10, TWE-15	Plume shape, groundwater flow and particle tracking
PC-115R	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-116R	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-117	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-118	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-119	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-120	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-121	PC-59, PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-56	PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-58	DBMW-19, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-59	PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-60	PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-62	HMW-13 to 15, MW-S	Plume shape, groundwater flow and particle tracking
PC-68	HMW-13 to 15, MW-S	Plume shape, groundwater flow and particle tracking
PC-82	HMW-13 to 15, MW-S	Plume shape, groundwater flow and particle tracking
PC-83	HMW-13 to 15, MW-S	Plume shape, groundwater flow and particle tracking
PC-86	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking

Table 2. Upgradient/Downgradient Well Sets
Shallow Zone –Eastside-Hook Area

Well	Companion Upgradient Wells	Basis
PC-87	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-91	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-92	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-93	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-99R2	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
PC-99R3	PC-60, PC-56, PC-58, PC-104, PC-103, PC-98R, MW-K5, PC-53, PC-1, PC-2	Plume shape, groundwater flow and particle tracking
UXO-16	MW-T, PC-110, HMW-14, MW-S, AA-10, HMW-15, HMW-16, TWE-15, TWC-15, TWI, MW-A-J, TWD1-17	Plume shape, groundwater flow and particle tracking
UZO-17	MW-T, PC-110, HMW-14, MW-S, AA-10, HMW-15, HMW-16, TWE-15, TWC-15, TWI, MW-A-J, TWD1-17	Plume shape, groundwater flow and particle tracking

— = Not applicable
MCL = U.S. Environmental Protection Agency Maximum Contaminant Level
BCL = Nevada Division of Environmental Protection Basic Comparison Level
ND = Not detected