**IRG Redevelopment I, LLC**

7991 Shaffer Parkway, Suite 300
Littleton, CO 80127
Phone: (303) 972 - 6633
Facsimile: (303) 972 - 6655

November 6, 2012

Roger Doak
Geologist
Solid Waste Unit
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South, B2
Denver, CO 80246-1530

Curt Stovall, P.E.
Engineer
Federal Facilities Unit
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South, B2
Denver, CO 80246-1530

**SUBJECT:** Operable Unit 2 (OU2) Cap Penetration Plan, Former Lowry Air Force Base, Colorado

Dear Mr. Doak,

IRG Redevelopment I (IRGI) is submitting this letter work plan to perform subsurface investigations at its property, which includes the former landfill (OU2), located at the former Lowry Air Force Base (Lowry). The preliminary approach to these subsurface investigations as well as a Draft Materials Management Plan (MMP) was first presented by IRGI in the document titled "Conceptual Revised Closure Plan (30%) for Lowry Vista Redevelopment submitted on May 28, 2008. On July 11, 2008 IRGI received comments on these documents from the Colorado Department of Public Health and Environment ("CDPHE" or the "Department").

The procedures outlined in this letter work plan will apply to all future investigative work where cap penetrations are proposed for these activities. Once the results of these activities are known, IRGI will provide a Revised Closure Plan and request to modify the State Environmental Covenant.

The property is comprised of approximately 78.1 acres of vacant land east of the AMLI apartments, located north of East Alameda Avenue at its intersections with Clinton and South Xenia Streets in Denver, Colorado (see Figure 1). IRGI's redevelopment plans contemplate a mixed-use redevelopment, including commercial and multi-family uses.

A large portion of the Site is impacted by restrictions due to its historic activities associated with the base landfill. With the transfer of the Site in 2006, a State Environmental Covenant (See Attachment A) was placed on the property, which states:

> *a. Unless the Covenant is modified in accordance with the State's statute and regulations, OU2 will only be used as open space/ non-irrigated park following closure.*
>
> *b. In general, the OWNER shall not use or conduct any activity on OU2 that will adversely affect:*
>
> *i. the integrity of the cover*
> *ii. the effectiveness of drainage or erosion controls*
> *iii. slope stability, or*
> *iv. groundwater or gas monitoring or control systems.*

*Specifically, no activity shall be conducted or permitted by the OWNER, nor shall the OWNER use OU2 in any manner that is inconsistent with the use designated in the preceding paragraph or that is not in compliance with the requirements of section 3.6.1(A) of 6 CCR 1007-2 or the Final Closure Plan for the Operable Unit 2 (OU2) Landfill Closure at Lowry, issued for review August 29, 2003, as finalized after Department review and approval.*

> *c. The OWNER shall not extract or utilize in any manner whatsoever any water from the upper aquifer below the surface of the ground within OU2 for any purpose whatsoever, unless the OWNER shall first have obtained the prior written approval of the Department.*

In order to evaluate the redevelopment of this area, IRGI has been working with the Department in creating a review and approval process for performing pre-development activities (e.g., subsurface investigations) at the Site. At this time, IRGI is not proposing any change in use of the Site.

As owner of the Site, IRGI is responsible for compliance with the State Environmental Covenant. The procedures presented in this document for cap penetration are intended to provide IRGI and prospective buyers an approved process for site-specific due diligence issues associated with the potential redevelopment of this area, and to ensure that any intrusive activities are conducted with appropriate precautions in order to be protective of human health and the environment, protect and restore the integrity of the landfill cap, and not adversely impact the current post-closure program.

# Site Background

OU2 was historically used for disposal of base-related waste and associated construction and demolition debris. Disposal most likely occurred from approximately 1948 until 1986. Disposal was generally done in trenches that were excavated in the landfill surface. IRGI conducted an extensive review of historical aerial photographs of the Lowry Vista site to identify trenching/disposal locations. Based on this

analysis, approximately 14 % of the overall area of the OU2 is covered with waste disposal trenches (see Figure 1). It is assumed that the remaining area outside of the trenches is native or disturbed fill materials.

Major investigations were conducted at OU2 during the 1990 Remedial Investigation (RI), 1995 Supplemental Remedial Investigation (SRI), and the 1998 Focused Feasibility Study (FFS) to determine the nature and extent of contamination present in soil, soil gas, surface water, and groundwater.

CDPHE approved the final construction report for the new OU2 soil cap in September 2006. As stated in this report, the current in-place remedy included construction of an 18-inch-thick low permeability layer ("LPL") with a maximum hydraulic conductivity (permeability) of $1 \times 10^{-5}$ centimeters per second over the entire area using soil from offsite borrow sources; placement of a 6-inch-thick vegetative layer on top of the LPL using soil imported from offsite borrow sources; installation of landfill gas vents and monitoring probes in culvert extension bedding material and around the southern and western perimeters of the landfill on 200-foot centers; and construction of surface water drainage structures to control run-on and runoff from the 100-year, 24-hour storm. Import and stockpiling of soil began in late 2003, and construction was completed in the fall 2004. When OU2 was transferred from the Air Force to the Lowry Redevelopment Authority ("LRA"), the State Environmental Covenant was placed upon the property in order to protect the current remedy. However, the restrictive covenant provides for modification of the remedy and will allow other uses so long as it is done in a way that is in accordance with the law and protective of human health and the environment**.**

Groundwater, surface water, and soil gas monitoring are also ongoing following the schedule set forth in the Corrective Action Plan for the Operable Unit 2 Landfill Closure at Lowry (Phase 2 CAP). As of January 2012, eight (8) semi-annual monitoring events have been completed following the initial two (2) years of quarterly baseline monitoring. All quarterly, semi-annual, and annual summary reports have been submitted to CDPHE. The results of this monitoring indicate that chemicals of concern are not leaching from the landfill mass into groundwater and no issues that would cause concern have been detected.

Groundwater and surface water sampling is being conducted to monitor water quality and to detect potential leachate contamination that may originate from OU2. The monitoring network set forth in the Phase 2 CAP, Appendix G, Post Closure Monitoring Plan currently includes nine groundwater monitoring wells and three surface water sample locations along Westerly Creek. During the first six (6) years of post-closure monitoring, groundwater and surface water samples were collected quarterly and analyzed for general water quality parameters, metals, volatile organic compounds, and radionuclides (gross alpha and gross beta). Following this baseline monitoring, the frequency decreases to semiannually. In accordance with the plan, samples are collected to measure volatile organics, metals and radiological parameters in groundwater surrounding the landfill. The data are then reviewed statistically to identify potential releases from the landfill; no releases have been observed.

Soil gas monitoring is being conducted to ensure that any detected methane gas concentrations in the subsurface soil do not exceed the lower explosive limit (LEL) of methane. Twenty-seven (27) above ground monitoring probes, located in the western and southern portion of the OU2 landfill, were installed to monitor for the presence of methane gas. As of the January 2012 quarterly sampling event, none of the sporadic detections of methane in soil gas probes have equaled or exceeded the action levels set forth in the Phase 2 CAP.

The documents referenced above are available for review and study by the public at the CDPHE HMWMD Records Center located at 4300 Cherry Creek Drive South, Denver. A project library is also maintained by Lowry Assumption, LLC in its office located at 7290 East 1st Ave, Denver; an appointment to review documents at the project library can be made by calling (303) 972-6633. These key documents are also available on the internet at the U.S. Air Force Administrative Record for the Former Lowry Air Force Base at https://afrpaar.lackland.af.mil/ar/docsearch.aspx

# Site Investigation Requirements

IRGI and prospective buyers will need to perform landfill cap subsurface investigations in order to:

- Confirm the location, contents, and distribution of waste trenches and other fill materials beneath the cap;
- Obtain geotechnical information for the design of buildings, roadways, and utilities;
- Ascertain if landfill gas exists directly above identified trenches to evaluate potential mitigation needs for the construction of residential and commercial buildings, roadways, and utilities; and,
- Identify bedrock elevations. This may include penetrating groundwater.

Generally, the subsurface investigations will be accomplished by the use of one of two investigation methods, depending on the conditions and the specific needs/requirements of a specific location. The two methods are:

1) Truck/track-mounted, direct push technology (DPT) methods; and,

2) 4-inch diameter hollow-stem auger (HSA) drilling using a truck/track-mounted CME-55 drilling rig.

The DPT method will be used for shallow environmental subsurface investigations primarily focused on the location and character of the waste trenches and soil gas. The HSA method will be primarily used for geotechnical subsurface investigations focused on the engineering properties of the underlying materials (soil, waste, bedrock).

An initial investigation will be initially be performed by IRGI. Subsequent investigations may be performed by IRGI or others. Attachment B contains the work plan for IRGI's initial investigation. In general, the investigation will consist of:

- Initial subsurface geotechnical conditions will be investigated by drilling up to thirty-eight (38) HSA exploratory boring locations inside the environmental mitigation zone (covenant boundary). The geotechnical study is designed to assist in determining the design criteria for planning and site development purposes.

- Initial subsurface exploration will be conducted at up to two-hundred fifty-six (256) DPT boring locations inside the environmental mitigation zone (covenant boundary) to confirm locations of waste trenches, subsurface soil conditions below the cap, and the condition of potential borrow source soil for beneficial re-use.

- A soil gas survey will be conducted by installing twenty-eight (28) soil gas probes at varying depths above trench locations at the Site.

Fieldwork, engineering analyses, and report preparation will be conducted under the supervision of a registered professional engineer. IRGI will provide on-site personnel with operational protocols to complete the test hole advancement in compliance with applicable regulations and guidelines as they pertain to personnel safety, environmental monitoring, materials handling, equipment decontamination, etc., again, utilizing any mandatory procedures outlined herein. All site work will be completed by certified HAZWOPER-trained personnel.

Samples and materials brought to the surface will be visually assessed for the possible presence of solid waste, asbestos, hazardous materials, etc. This will be performed by the subcontractor performing the work, and IRGI will perform construction oversight of all such activities to assure that materials are handled properly.

## Discovery and Handling of Visually Impacted Materials

All investigative derived waste (IDW) will be containerized for disposal. All materials removed from the subsurface will be segregated into potentially contaminated (below cap) and uncontaminated soils (LPL and vegetative layer--upper 2 feet). All material removed from beneath the cap will be containerized and characterized for proper disposal as outlined in the IDW management section below. The containerized materials will be designated for appropriate disposition as discussed in the IDW management section of this work plan.

All visually impacted materials when encountered will be managed as follows:

1. A written description and a sketch of the location of the material will be documented in the field notebook.

2. Based on the type of material encountered, appropriate PPE will be used during handling and removal of these materials for evaluation and or disposal.

3. Visually impacted materials will be removed with care taken to avoid spreading the contamination into an uncontaminated area. Proper protections will be utilized when assessing material brought to the surface (i.e. 6 mil polyethylene plastic)

## IDW Management and Equipment Decontamination

All IDW will be containerized. Drilling waste will be placed either into 55-gallon drums or roll-off by the drilling contractor. Each drum will be filled to 90-percent of capacity and sealed with a compatible lid. Decontamination water will be placed into a separate 55-gallon drums. All containers will be labeled non-hazardous waste pending analysis, with the following information at a minimum: the date generated, generator address, and contents. All IDW will be characterized as required for disposal. IDW will be analyzed for TCLP RCRA 8 metals, VOCs, DRO/GRO, PAHs, reactivity, corrosiveness, and ignitability (RCI). A qualified environmental consultant will perform the sampling. All IDW will be manifested according to the IDW characterization results and properly disposed of at the appropriate disposal facility. No containerized materials will be stored for more than 90 days after accumulation. Under no circumstances will drill cuttings or cores be placed back into the borehole.

IDW generated during field activities may include decontamination water, soil accumulated in decontamination water, soil cuttings, and other wastes (expendable personal protective equipment [PPE], plastic bags, paper towels, etc.). Waste management practices implemented for environmental investigations are summarized below.

*Liquid Investigation-Derived Waste*

Decontamination and well development purge water will be containerized in U.S. Department of Transportation approved 55-gallon drums. When the containers are full, samples of the liquid IDW will be collected.. Results of these analyses will determine appropriate disposal options for the liquid waste. Historically, analytical results below the MCLs for liquid IDW samples have allowed discharge of IDW liquid to storm sewer system at Lowry.

*Solid Investigation-Derived Waste*

Saturated soil cuttings will be containerized and characterized for potential disposal. All IDW will be managed on site until characterization is complete.

Residual soil from equipment decontamination procedures will be containerized in dumpsters or drums. When the volume in the container reaches the container capacity, composite samples (one for each analysis) will be collected for characterization. Based on analytical results, soil IDW will be disposed as either hazardous or non-hazardous waste.

*Other Investigation-Derived Waste*

Other IDW (i.e., used PPE) will be treated as ordinary solid waste and disposed using usual waste collection practices at the site. These wastes will be disposed in a local sanitary landfill.

*Equipment Decontamination*

Equipment mobilizing from one area to another will be thoroughly decontaminated as to not spread potential contaminants across the Site. A centralized equipment decontamination area will be set up off of the cap. Heavy accumulations of potentially contaminated materials will be removed by scraping with a shovel or similar tool and, where appropriate, by brushing with stiff bristle brushes. Collected decontamination IDW will be decanted into separate containers for solid and liquid material.

All equipment that may come in contact with samples will be decontaminated at the onsite decontamination area. All non-disposable sampling equipment that can be hand-manipulated will be decontaminated in accordance with the following procedures:

1. Scrub with a solution of "approved" water and Alconox®, or equivalent laboratory-grade detergent.

2. Thoroughly rinse all equipment with clean potable water.

Allow decontaminated equipment to air dry. If the sampling device will not be used immediately, it should be wrapped or placed on clean plastic.

*Soil Containers*

Soil destined for off-site disposal will be placed in lined, transportable containers that will be kept in the designated area. After the soil has been placed in the containers and sampled for waste designation in accordance with disposal facility requirements, the containers will be covered and secured. The condition of the containers and soil will be determined during weekly inspections by IRGI until they are removed from the site. Containers will be managed as if they were hazardous waste, but labeled "Pending Analysis" until such time as test results on the corresponding waste designation samples demonstrate that the soil is hazardous or not. Based on analytical results, the container labels will be changed to reflect the waste's regulatory status as hazardous or non-hazardous.

*Saturated Soils Procedures*

If IRGI or third party buyer encounters soil that is saturated with groundwater during investigative activities, the saturated soil will be segregated and containerized in a 55-gallon steel drum or lined rolloff. Precautions such as placement of plastic on the surface, or erection of a berm will be taken to ensure that potentially contaminated groundwater water does not spill onto the surface or run off the site. Containerized soil will be sampled to characterize it for disposal and manifesting purposes by the contractor as outlined above. Furthermore, if groundwater is encountered, the equipment that comes in contact with the soil cuttings will be decontaminated nearby the worksite (not on the cap). Any equipment that may have contacted groundwater will be thoroughly rinsed clean with water. The water and soil will be collected in a tub or trough will be containerized and characterized and/or properly disposed in the same manner as described in the IDW management section below. If groundwater is encountered, notifications will be made to CHPHE as to the nature and extent of the encounter as dictated by the State Environmental Covenant. It is not anticipated that such an encounter will be made without obtaining prior written approval from CDPHE.

## Dewatering Procedures

In no case will dewatering be performed without the prior approval of the CDPHE. In cases where pumping of contaminated groundwater is required and approved by the CPDHE, the contractor will containerize the groundwater and then sample it for characterization and disposal as outlined in the IDW Management Section above. Groundwater with sampling results below the Colorado Basic Groundwater Standards ("CBGS" or "Regulation 41") will be land-applied or used as dust suppression (not on the cap) according to the best management practices (BMPs) developed for disposal of containerized groundwater. The BMPs include an application rate no greater than one inch per acre per week; visual inspections to ensure no ponding or runoff; written logs documenting application rates, weather, and visual observations; and photographic documentation. Groundwater exceeding the CBGS will be stored and disposed of in accordance with all federal, state, and local regulations or may be treated on site in accordance with Appendix 2 of CDPHE's Corrective Action Guidance Document (May, 2002 - http://www.cdphe.state.co.us/hm/caguidance.pdf).

## Borehole Abandonment Procedures

Borehole abandonment will be performed, at a minimum, in accordance with applicable State of Colorado regulations regarding test hole/borehole abandonment specifically the State Engineers Office RULE 16 STANDARDS FOR PLUGGING, SEALING, AND ABANDONING WELLS AND BOREHOLES. Site-specific additional requirements required, include documentation of total test hole depth and depth to static water (if encountered) to be measured at each test hole prior to abandonment. Borings will be abandoned by filling each test hole with medium bentonite chips to the ground surface. The bentonite chips will be poured directly into the test hole and hydrated with a minimum of 5 gallons of potable water. Once hydrated, the bentonite will swell and seal off the borehole. This will ensure that the

permeability of the test hole from top to bottom will be significantly less than the permeability of the surrounding soils, the LPL, and the vegetative layer. Settlement of the hydrated bentonite shall be checked 24 hours after it is placed prior to restoration of the vegetative layer. If settlement is identified (> 6 inches), additional bentonite will be added and hydrated so that it extends beyond the LPL to the ground surface.

If monitoring wells are installed in the future, they will be abandoned in accordance with applicable State of Colorado regulations regarding test hole/borehole abandonment specifically the State Engineers Office RULE 16 STANDARDS FOR PLUGGING, SEALING, AND ABANDONING WELLS AND BOREHOLES. Site-specific procedures will require the well to be over drilled to at least 2 feet below the ground surface. The well will be plugged by filling the well to the static water level with clean 10/20 clean sand, then with medium chip bentonite or high solid bentonite grout to top of casing then hydrated with at least 5 gallons of clean water if using chips. The casing will be removed to at least two feet below ground surface. The over drilled hole shall be filled with medium bentonite chips to the ground surface and hydrated with several gallons of clean water. This will insure that the materials added are less permeable than the surrounding LPL soils. Any damage caused to the vegetative layer will be restored according to the vegetative layer repair section below.

## Hazardous Materials and Wastes

No hazardous materials are expected to be stored on site. Hazardous materials are defined as those chemicals subject to reporting requirements under Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA). Petroleum liquids such as fuel, oil, and grease used for drilling and other equipment will be supplied offsite to support investigation activities. There will be no storage of liquid petroleum fuels such as diesel on site and no refueling will occur on the cap.

## Spill Response

The person who discovers a petroleum leak shall first inform IRGI and the contractor to coordinate an appropriate response. Immediate remedial actions to be performed in the event of a spill include:

1) Minimize fire hazards associated with the fuel spill by extinguishing any open flames or ignition sources in the vicinity of the spill;
2) Minimize exposure of personnel to the spilled material;
3) Assess if the spilled material is sufficiently contained, and use on-site equipment to contain the material with soil berms, if needed; and
4) Remove contaminated soil and dispose of as appropriate.

In addition, the LAC oversight coordinator will be notified in the event of a significant spill or release.

# Vegetative Layer Repair

Cap repair and re-vegetation for boreholes is not expected to be required since the size of the disturbance is expected to be small and the bentonite seals are expected to be better than or equal to the existing cap. Areas of disturbed vegetation will be documented and restored as necessary. If the vegetative layer and native grasses are damaged during the subsurface investigations, then the damaged areas will be repaired as described below or for larger damaged areas as outlined in the OU2 Phase 2 Cap specifications (02921-Seeding) located in Attachment C, or as recommended by EPA, 1993, *Technical Guidance Document, Quality Assurance and Quality Control for Waste Containment Facilities*, EPA/600/R-93/182.

## Preparation and Seeding

All damage to the vegetative layer including but not limited to: ephemeral rill erosion features, ruts, depressions, gouges, scrapes caused by planned investigations will be repaired by smoothing out the damaged vegetative layer area soils in preparation for re-seeding. Additional clean soil will be brought in to fill any depressions to prevent ponding. Bare surfaces will be prepared by texturizing the soil prior to seeding. The approved OU2 seed mixture will be used for seeding in the restoration area (Attachment C). The approved seed mixture will be hand broadcast over the entire restored area.

## Erosion Mat

For large damaged area repairs in existing drainage channels, the reseeded area will receive new short-term temporary erosion control blanket to provide erosion control, sediment control, vegetation establishment, and/or vegetation reinforcement. The matting should extend to the limits of the damaged and re-seeded area. The erosion control blanket will be installed according to staple pattern recommended by the supplier installation instructions. An example product and staple pattern instructions are provided in Attachment D.

## Cap Penetration Documentation

IRGI will collect and maintain complete records (log books, drawings, test results, reclamation activities, etc.) of all cap penetration activities and will provide copies to CDPHE upon request. The results of the initial investigation (Attachment A) will be summarized in the forthcoming revised closure plan.

# Closing

IRGI appreciates the Department's willingness to work with us on this important project. No modifications to this plan will be made without the Department's prior approval. If you have any questions regarding the procedures outlined in this plan, please contact me at (303) 972-6633.

Sincerely,
IRG-Redevelopment I, LLC

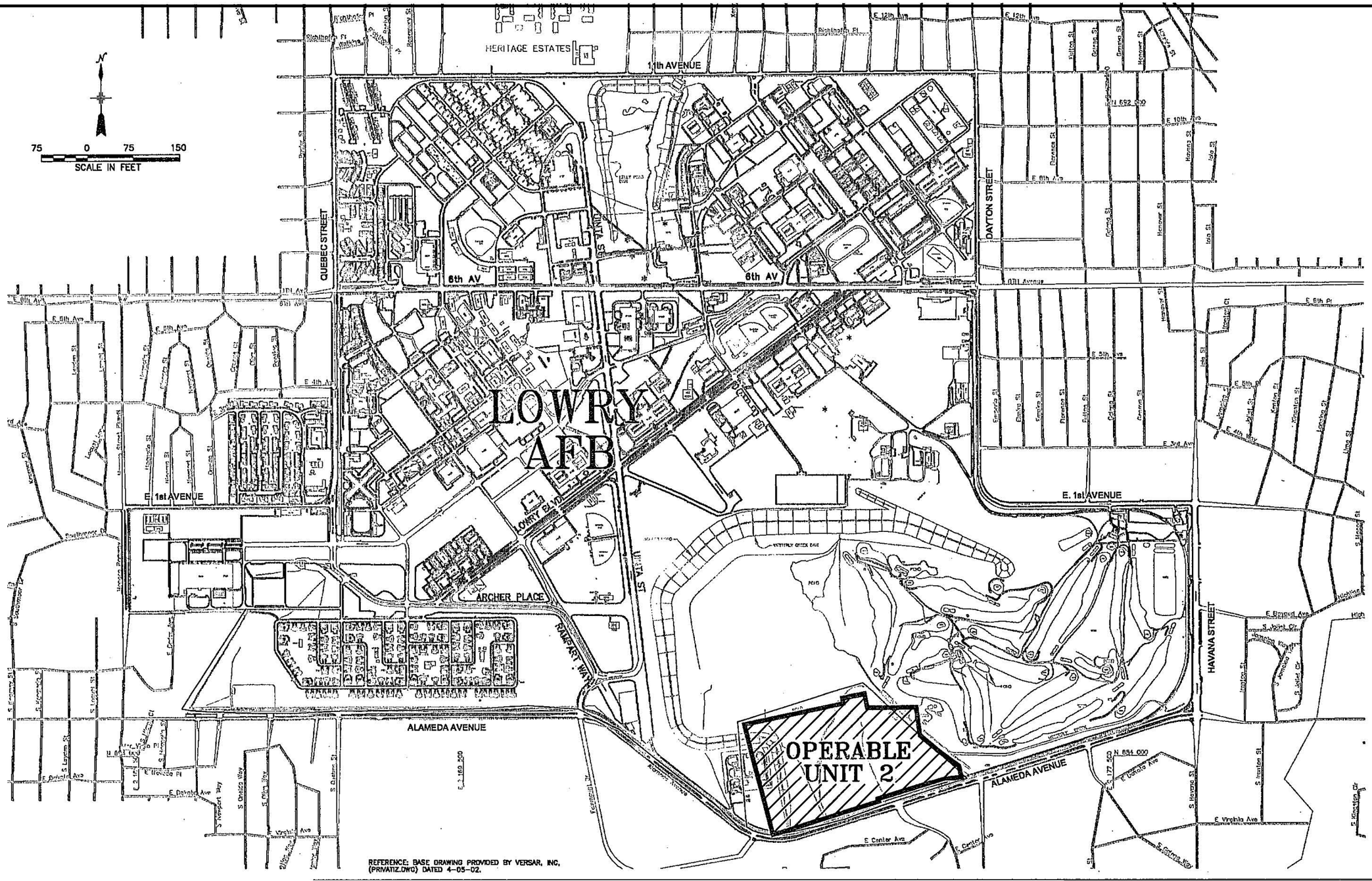
Brent C. Anderson
President

Attachments:

Figure 1- Site Map
Attachment A – Environmental Covenent
Attachment B – Initial Investigation Work Plan
Attachment C – Seeding Specification
Attachment D – Erosion Mat Information

Distribution:

Joe Aiken, IRG Assumptions, LLC
Ann Wei – IRG
John Yerton –IRG Assumptions, LLC
Paul Carroll - Air Force
Stanley Pehl – Air Force
Monty Force – LRA
Peter Goffstein – Industrial Realty Group
Brad Coleman, P.E. – Walsh Environmental
Lowry Project File




IRG

**Figure 1**
**Lowry Vista / OU2**
**Cap Penetration Letter Work Plan**
**Former Lowry Air Force Base**
**IRG– Assumptions, LLC**

**ATTACHMENT A**

# This property is subject to an Environmental Covenant held by the Colorado Department of Public Health and Environment pursuant to section 25-15-321, C.R.S.

## ENVIRONMENTAL COVENANT

The United States of America, acting by and through the Secretary of the Air Force, under and pursuant to the powers and authority contained in the Defense Base Closure and Realignment Act of 1990, as amended (10 U.S.C. § 2687, note) ("Grantor") grants an Environmental Covenant ("Covenant") this 4th day of January, 2006 to the Hazardous Materials and Waste Management Division of the Colorado Department of Public Health and the Environment ("the Department") pursuant to § 25-15-321 of the Colorado Hazardous Waste Act, § 25-15-101, *et seq*. The Department's address is 4300 Cherry Creek Drive South, Denver, Colorado 80246-1530.

WHEREAS, the Grantor is the owner of certain property associated with the former Lowry Air Force Base ("LAFB"), located in Denver, Colorado, more particularly described in Attachment A, attached hereto and incorporated herein by reference as though fully set forth (hereinafter referred to as the "Property"); and

WHEREAS, pursuant to Consent Agreement Number 01-08-07-02, the Property is the subject of enforcement and remedial action pursuant to the Colorado Hazardous Waste Act, § 25-15-301, et. seq. ("CHWA"). The Property was the former base landfill (also known as Operable Unit 2 (OU2)). OU2 was historically used for disposal of Air Force waste, and associated construction waste and debris primarily from training activities conducted at LAFB. OU2 has been closed in accordance with the Phase 2 Corrective Action Plan for the Operable Unit 2 Landfill Closure at Lowry; and,

WHEREAS, the purpose of this Covenant is to ensure protection of human health and the environment by minimizing the potential for exposure to any hazardous substance, hazardous waste, hazardous constituents, and/or solid waste that remains in the landfill on the Property. The Covenant will accomplish this by prohibiting those activities that may interfere with the landfill cover or its monitoring or control systems and by creating a review and approval process to ensure that any such intrusive activities are conducted with appropriate precautions to avoid or eliminate any hazards; and

WHEREAS, the Grantor desires to subject the Property to certain covenants and restrictions as provided in Article 15 of Title 25, Colorado Revised Statutes, which covenants and restrictions shall burden the Property and bind the Grantor, and all parties having any right, title or interest in the Property, or any part thereof, its heirs, successors, assigns, and any persons using the land, as described herein, for the benefit of the Department.

NOW, THEREFORE, the Grantor hereby grants this Environmental Covenant to the Department, and declares that the Property as described in Attachment A shall hereinafter be bound by, held, sold, and conveyed subject to the following requirements set forth in paragraphs 1 through 10 below, which shall run with the Property in perpetuity and be binding on Grantor and all parties having any right, title, or interest in the Property, or any part thereof, their heirs,

successors and assigns, and any persons using the land, as described herein. As used in this Environmental Covenant, the term OWNER means the record owner of the Property and, if any, any other person or entity legally authorized to make decisions regarding the transfer of the Property or placement of encumbrances on the Property, other than by the exercise of eminent domain.

1. Use restrictions

a. Unless the Covenant is modified in accordance with the State's statute and regulations, OU2 will only be used as open space/ non-irrigated park following closure.

b. In general, the OWNER shall not use or conduct any activity on OU2 that will adversely affect:

i. the integrity of the cover
ii. the effectiveness of drainage or erosion controls
iii. slope stability, or
iv. groundwater or gas monitoring or control systems.

Specifically, no activity shall be conducted or permitted by the OWNER, nor shall the OWNER use OU2 in any manner that is inconsistent with the use designated in the preceding paragraph or that is not in compliance with the requirements of section 3.6.1(A) of 6 CCR 1007-2 or the *Final Closure Plan for the Operable Unit 2 (OU2) Landfill Closure at Lowry*, issued for review August 29, 2003, as finalized after Department review and approval.

c. The OWNER shall not extract or utilize in any manner whatsoever any water from the upper aquifer below the surface of the ground within OU2 for any purpose whatsoever, unless the OWNER shall first have obtained the prior written approval of the Department.

d. For the duration of this covenant, the Air Force shall perform all of the requirements set forth in sections 3 and 4 of the Post-Closure Operation and Maintenance Plan, Appendix E of the *Final Closure Plan for the Operable Unit 2 (OU2) Landfill Closure at Lowry*, issued for review August 29, 2003, as finalized after Department review and approval.

2. Modifications This Covenant runs with the land and is perpetual, unless modified or terminated pursuant to this paragraph. The OWNER or its successors and assigns may request that the Department approve a modification or termination of the Covenant. The request shall contain information showing that the proposed modification or termination shall, if implemented, ensure protection of human health and the environment. The Department shall review any submitted information and may request additional information. If the Department determines that the proposal to modify or terminate the Covenant will ensure protection of human health and the environment, it shall approve the proposal. No modification or termination of this Covenant shall be effective unless the Department has approved such modification or termination in writing. Information to support a request for modification or termination may include one or more of the following:

a) a proposal to perform additional remedial work;
b) new information regarding the risks posed by the residual contamination;
c) information demonstrating that residual contamination has diminished;

d) information demonstrating that the proposed modification would not adversely impact the remedy and is protective of human health and the environment; and,
e) other appropriate supporting information.

3. Conveyances The OWNER shall notify the Department at least fifteen (15) days in advance of any proposed grant, transfer, or conveyance of any interest in any or all of the Property.

4. Notice to Lessees The OWNER agrees to incorporate, either in full or by reference the restrictions of this Covenant in any leases, licenses, or other instruments granting a right to use the Property.

5. Notification for proposed construction and land use The OWNER and/or its transferees shall notify the Department simultaneously when submitting any application to a local government for a building permit or change in land use at the Property.

6. Inspections The Department shall have the right of entry to the Property at reasonable times with prior notice for the purpose of determining compliance with the terms of this Covenant. Nothing in this Covenant shall impair any other authority the Department may otherwise have to enter and inspect the Property.

7. No Liability The Department does not acquire any liability under State law by virtue of accepting this Covenant, nor does any other named beneficiary of this Covenant acquire any liability under State law by virtue of being such a beneficiary.

8. Enforcement The Department may enforce the terms of this Covenant pursuant to §25-15-322. C.R.S. The Grantor and any named beneficiary of this Covenant may file suit in district court to enjoin actual or threatened violations of this Covenant.

9. Owner's Compliance Certification OWNER shall submit an annual Report to the Department, on the anniversary of the date this Covenant was signed by Grantor, detailing OWNER's compliance, and any lack of compliance, with the terms of this Covenant.

10. Notices Any document or communication required under this Covenant shall be sent or directed to:

Hazardous Waste Corrective Action Unit Leader
Hazardous Materials and Waste Management Leader
Colorado Department of Public Health and the Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246-1530

IN WITNESS WHEREOF, I have hereunto set my hand at the direction of the Secretary of the Air Force, the day and year first above written.

THE UNITED STATES OF AMERICA

By: Katy M. Halv
KATHRYN M. HALVORSON
Director
Air Force Real Property Agency

Witness:
Kathryn Peters

Commonwealth of Virginia :
ss.
County of Arlington :

The foregoing instrument was acknowledged before me this 4th day of January, 2006, by Kathryn M. Halvorson as the Director of Air Force Real Property Agency.

PAUL C. MACPHERSON
NOTARY PUBLIC
COMMONWEALTH
OF VIRGINIA
My Commission Expires
September 30, 2009

Witness my hand and official seal

Notary Public
My Commissions Expires on September 30, 2009

(seal)

Accepted by the Colorado Department of Public Health and Environment this 13th day of January 2006.

By: Gary W Baughman
GARY BAUGHMAN
Director
Hazardous Materials Waste Management Division

STATE OF COLORADO)
) ss:
COUNTY OF DENVER )

The foregoing instrument was acknowledged before me this 13th day of January 2006 by Gary W Baughman on behalf of the Colorado Department of Public Health and Environment.

Notary Public
Address: 4300 Cherry Creek Dr. S. Denver
My commission expires: 2-29-08.

IN WITNESS WHEREOF, I have hereunto set my hand at the direction of the Secretary of the Air Force, the day and year first above written.

THE UNITED STATES OF AMERICA

By: Kathryn M. Halvorson
KATHRYN M. HALVORSON
Director
Air Force Real Property Agency

Witness:
Kathryn Peters

Commonwealth of Virginia :
ss.
County of Arlington :

The foregoing instrument was acknowledged before me this 4th day of JANUARY, 2006, by Kathryn M. Halvorson as the Director of Air Force Real Property Agency.

Witness my hand and official seal

PAUL C. MACPHERSON
NOTARY PUBLIC
COMMONWEALTH
OF VIRGINIA
My Commission Expires
September 30, 2009

(seal)

Notary Public
My Commissions Expires on September 30, 2009.

Accepted by the Colorado Department of Public Health and Environment this 13th day of January 2006.

By: Gary W. Baughman
GARY BAUGHMAN
Director
Hazardous Materials Waste Management Division

STATE OF COLORADO)
) ss:
COUNTY OF DENVER )

The foregoing instrument was acknowledged before me this 5th day of January 2006 by Gary W. Baughman on behalf of the Colorado Department of Public Health and Environment.

Notary Public
Address 4300 Cherry Creek Dr S Denver
My commission expires: 2-29-08.

ATTACHMENT A

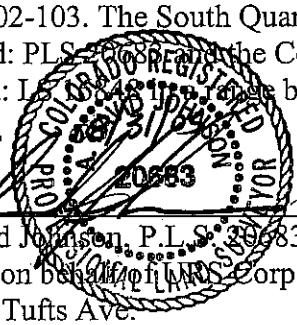
**DESCRIPTION**
**Parcel 2**

A part of the Southeast Quarter of Section 9, part of the Southwest Quarter of Section 10, part of the Northwest Quarter of Section 15 and part of the Northeast Quarter of Section 16, Township 4 South, Range 67 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado, being more particularly described as follows:

**COMMENCING** at the South Quarter Corner of said Section 10;
thence North 89°58'53" West, along the south line of said Southwest Quarter, a distance of 783.22 feet to the **POINT OF BEGINNING**;
thence South 07°03'57" East a distance of 221.72 feet;
thence South 51°58'32" East a distance of 782.86 feet;
thence South 72°23'13"West a distance of 1178.79 feet;
thence North 17°12'50"West a distance of 21.42 feet;
thence South 72°48'22" West a distance of 1336.10 feet to a point on the northerly line of Alameda Avenue described in Book 71 at Page 76 in the Clerk and Recorders Office of said City and County of Denver and a point of non-tangent curvature;
thence along said northerly line and along the arc of a curve to the right, having a central angle of 2°11'49", a radius of 904.36 feet, an arc length of 34.68 feet and whose chord bears North 83°39'08" West a distance of 34.67 feet;
thence North 14°07'41" West, non-tangent to the previous course, a distance of 1479.84 feet;
thence North 78°47'16" East a distance of 1002.84 feet to a point of non-tangent curvature;
thence along the arc of a curve to the left having a central angle of 67°12'34", a radius of 420.06 feet, an arc length of 492.74 feet and whose chord bears North 44°26'58" East a distance of 464.97 feet to a point of reverse non-tangent curvature;
thence along the arc of a curve to the right having a central angle of 144°09'24", a radius 92.97 feet, an arc length of 233.90 feet and whose chord bears North 82°51'54" East a distance 176.91 feet to a point of reverse non-tangent curvature;
thence along the arc of a curve to the left having a central angle of 22°39'25", a radius of 1395.92 feet, an arc length of 552.00 feet and whose chord bears South 37°48'58" East a distance of 548.41 feet;
thence North 89°39'24" East, non-tangent with the previous course, a distance of 321.63 feet;
thence South 07°03'57" East a distance of 123.98 feet to the **POINT OF BEGINNING**;

Containing 3,038,767 square feet or 69.760 acres, more or less.

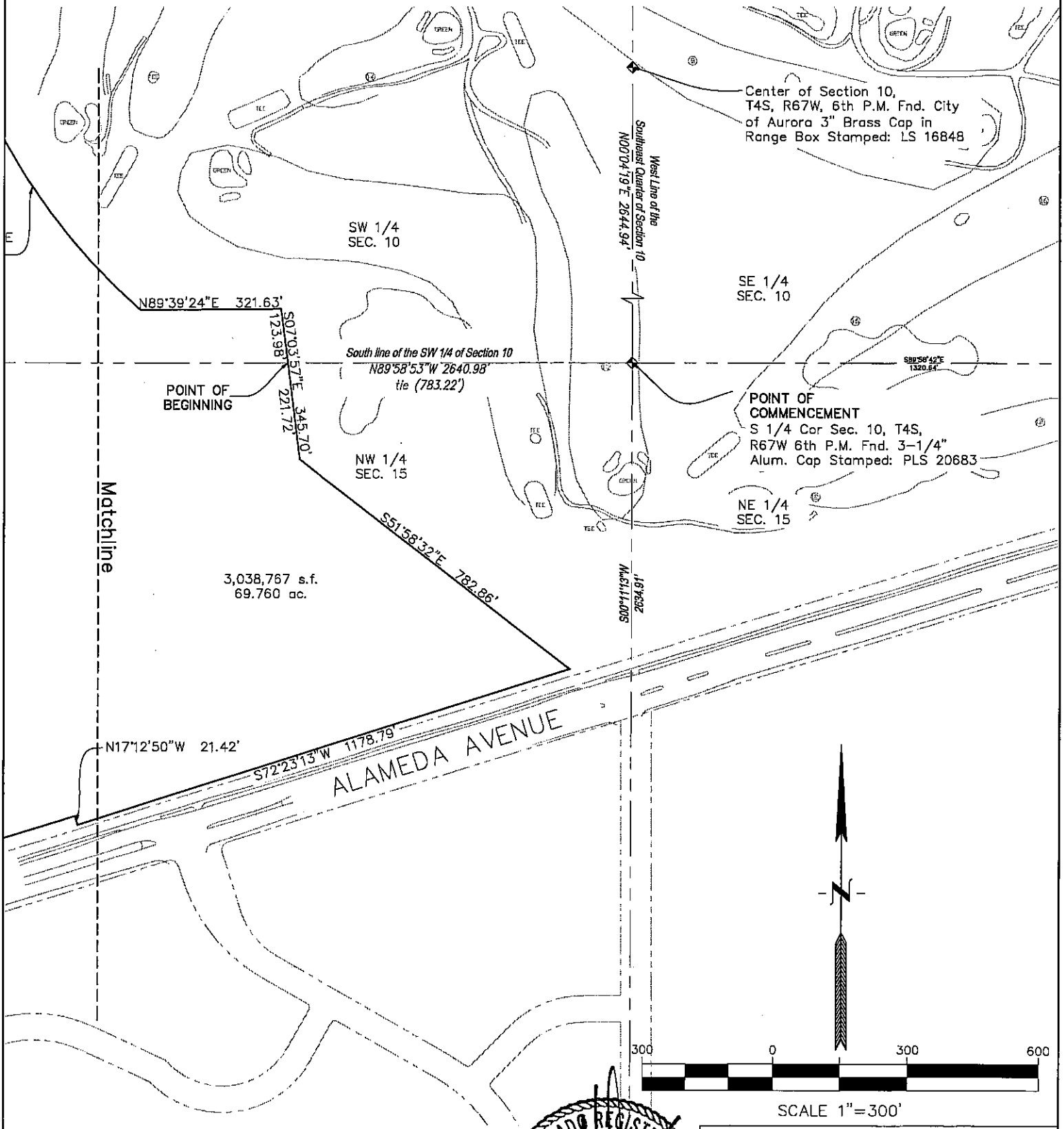
**Basis of Bearings**: Bearings are based on the west line of the Southeast Quarter of Section 10, Township 4 South, Range 67 West of the Sixth Principal Meridian as being North 00°04'19" East. The bearing of said line is shown on the City and County of Denver Lowry Air Force Base Boundary Survey under Project No. 94-576, dated 4/09/96 and filed in Book 23 of the County Surveyor's Land Survey/Right of Way Surveys at Pages 102-103. The South Quarter Corner of Section 10 is a found 3-1/4" Aluminum cap Stamped: PLS 20683, and the Center Quarter corner of Section 10 is a found 3" brass cap stamped: LS 18481, in range box.




08/31/05

A. David Johnson, P.L.S. 20683
For and on behalf of LWS Corp.
8181 E. Tufts Ave.
Denver, CO 80237
Ph. 303.740.2600
K:\Projects\Lowry Undeeded Areas\Landfill\Landfill.doc
8/30/2005 9:01 AM

# EXHIBIT




COLORADO REGISTERED DAVID JOHNSON 20683 PROFESSIONAL LAND SURVEYOR 08/31/05

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

K:\Projects\Lowry Undeeded Areas\Landfill.dwg 8/26/2005 8:00:08 AM MST


URS
8181 E. TUFTS AVENUE
DENVER, CO 80237
Ph: 303-740-2600
Fax: 303-694-3946

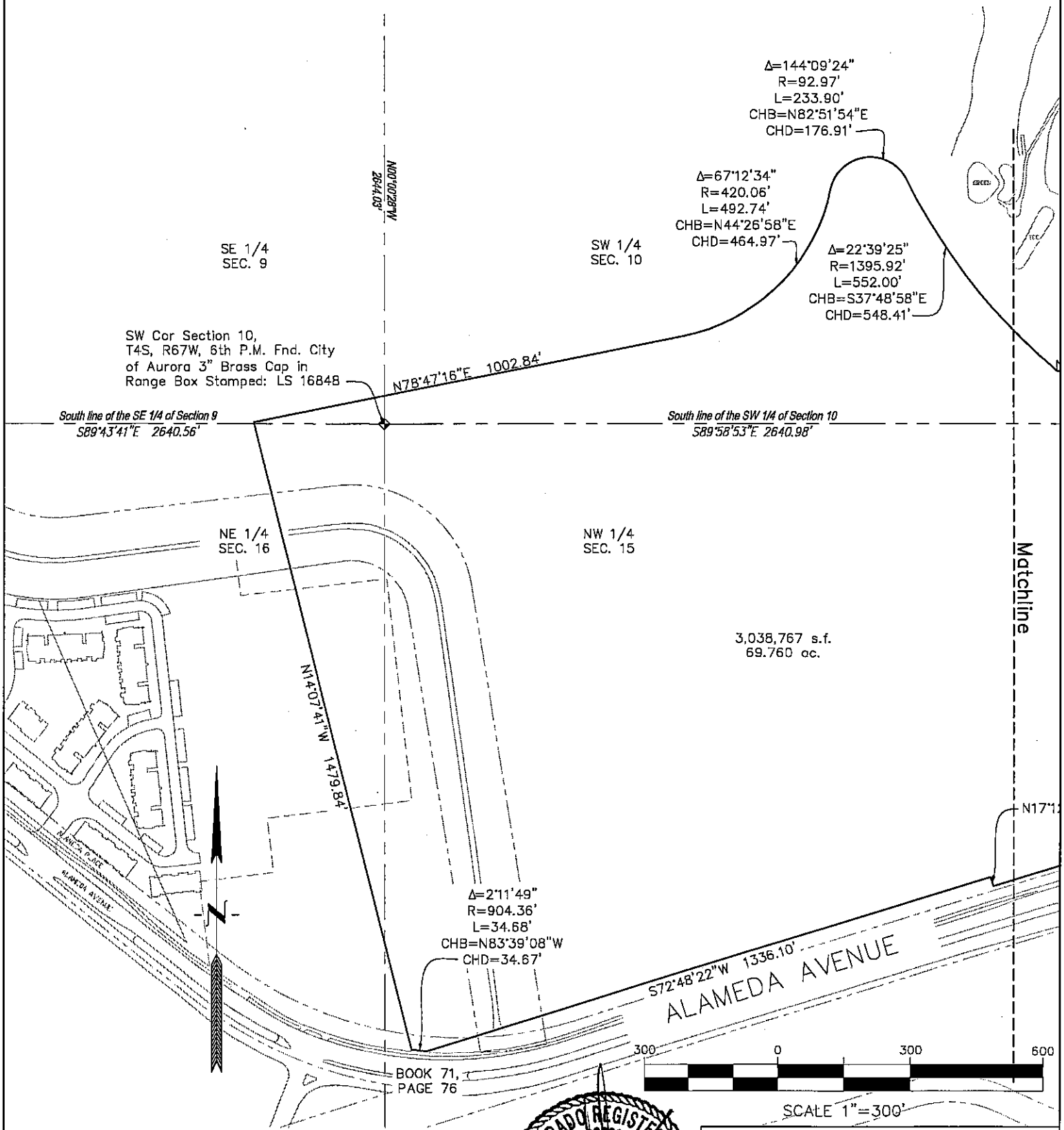

EXHIBIT ACCOMPANYING DESCRIPTION

## PARCEL 2 EXHIBIT

DENVER COLORADO

| Drawn by: DEA | Checked by: ADJ | Sheet No. 1 | of 2 Sheet(s) |
|---|---|---|---|

# EXHIBIT




COLORADO REGISTERED
A. DAVID JOHNSON
20683
PROFESSIONAL LAND SURVEYOR

*This exhibit does not represent a monumented survey. It is intended only to depict the attached description.*

K:\Projects\Lowry Undeeded Areas\Landfill.dwg 8/26/2005 8:00:08 AM MST

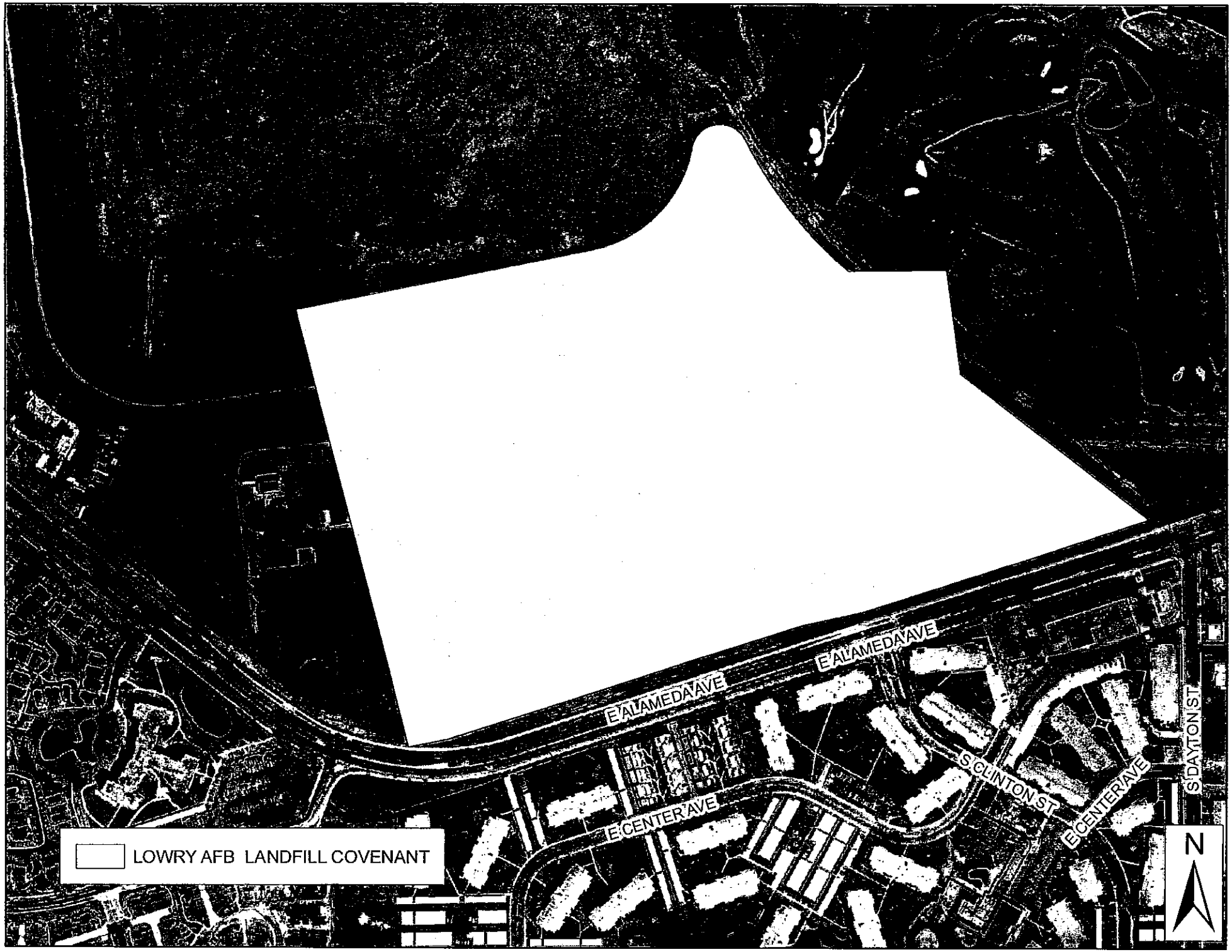

**URS**
8181 E. TUFTS AVENUE
DENVER, CO 80237
Ph: 303-740-2600
Fax: 303-694-3946


EXHIBIT ACCOMPANYING DESCRIPTION

## PARCEL 2 EXHIBIT

DENVER COLORADO

| Drawn by: DEA | Checked by: ADJ | Sheet No. 2 | of 2 Sheet(s) |
|---|---|---|---|


E ALAMEDA AVE
E ALAMEDA AVE
S CLINTON ST
E CENTER AVE
E CENTER AVE
S DAYTON ST
LOWRY AFB LANDFILL COVENANT
N

**ATTACHMENT B**

# Lowry Vista

## Work Plan for Subsurface Soil Borings on the Landfill Zone, Operable Unit 2 (OU2)

## Former Lowry Air Force Base, Colorado



Prepared for:

**IRG Redevelopment I**

7991 Shaffer Parkway, Suite 300

Littleton, Colorado

Prepared by:

**IRG Assumptions, LLC**

## Table of Contents

# 1.0 Introduction

This Work Plan has been prepared for a subsurface investigation to be conducted on the IRG Redevelopment I (IRGI) property (Site), which includes the former landfill (OU2), located at the former Lowry Air Force Base (Lowry). Comprised of approximately 78.1 acres of vacant land, the property is located east of the AMLI apartments, located north of East Alameda Avenue at its intersections with Clinton and South Xenia Streets in Denver, Colorado (see Figure 1). IRGI plans on providing a full response to CDPHE comments to the May 2008 30% Revised Closure Plan and draft MMP as part of the future submittal of the Draft Revised Closure Plan that would address issues other than geotechnical borings. In the meantime, this work plan, an attachment to the Cap Penetration Plan, is provided to outline the scope of the subsurface boring investigation that is planned on the Site.

# 2.0 Site Background

The OU2 Landfill Zone encompasses approximately 69.8 acres and is located in the southern portion of the former Lowry Air Force Base (LAFB) in the city of Denver, Colorado, approximately 5 miles east of downtown Denver. The OU2 Landfill Zone is bordered by Alameda Avenue to the south, the Westerly Creek Dam wetlands to the north, Westerly Creek to the east, and AMLI multi-family units to the west of the dam embankment.

The landfill was historically used for disposal of base-related waste and associated construction waste and debris primarily from training activities conducted at the former LAFB. Disposal most likely occurred from approximately 1948 until 1986. Disposal was generally done in trenches that were excavated in the landfill surface. LAC conducted an extensive review of historical aerial photographs of the Lowry Vista site to identify trenching/disposal locations. Based on this analysis approximately 14 % of the overall area of the OU2 Landfill Zone is covered with waste disposal trenches (see Figure 2). It is assumed that the remaining area outside of the trenches is native or disturbed fill materials. In addition, major investigations were conducted at the OU2 Landfill Zone during the 1990 Remedial Investigation (RI), 1995 Supplemental Remedial Investigation (SRI), and the 1998 Focused Feasibility Study (FFS) to determine the nature and extent of contamination present in soil, soil gas, surface water, and groundwater. Reports for all of these activities are available as part of the Administrative Record for the Lowry site.

# 3.0 Scope/Specified Procedures

IRGI will perform landfill cap subsurface investigations in order to:

- Confirm the location, contents, and distribution of waste trenches and other fill materials beneath the cap;

- Obtain geotechnical information for the design of buildings, roadways, and utilities;
- Ascertain if landfill gas exists directly above identified trenches to evaluate potential mitigation needs for the construction of residential and commercial buildings, roadways, and utilities; and,
- Identify bedrock elevations. This may include penetrating groundwater.

Generally, the subsurface investigations will be accomplished by the use of one of two investigation methods, depending on the conditions and the specific needs/requirements of a specific location. The two methods are:

1) Truck/track-mounted, direct push technology (DPT) methods; and,

2) 4-inch diameter hollow-stem auger (HSA) drilling using a truck/track-mounted CME-55 drilling rig.

The DPT method will be used for shallow environmental subsurface investigations primarily focused on the location and character of the waste trenches and soil gas. The HSA method will be primarily used for geotechnical subsurface investigations focused on the engineering properties of the underlying materials (soil, and waste).

In general, the investigation covered by this work plan will consist of:

- Initial subsurface geotechnical conditions will be investigated by drilling up to thirty-eight (38) HSA exploratory boring locations inside the environmental mitigation zone (covenant boundary). The geotechnical study is designed to assist in determining the engineering design criteria for planning and site development purposes.

- Initial subsurface exploration will be conducted at up to two-hundred fifty-six (256) DPT boring locations inside the environmental mitigation zone (covenant boundary) to confirm locations of waste trenches, subsurface soil conditions below the cap, and the condition of potential borrow source soil for beneficial re-use.

- A soil gas survey will be conducted by installing twenty-eight (28) soil gas probes locations inside the environmental mitigation zone (covenant boundary) at varying depths above trench locations at the Site.

Fieldwork, data collection, sampling for chemical analysis, and report preparation will be conducted under the supervision of an environmental professional. Geotechnical analysis will be conducted under the supervision of a registered professional engineer. IRGI will provide on-site personnel with operational protocols to ensure that test hole advancement is in compliance with applicable regulations and guidelines as they pertain to personnel safety, environmental

monitoring, materials handling, equipment decontamination, etc., again, utilizing any mandatory procedures outlined herein.

Samples and materials brought to the surface will be visually assessed for the possible presence of solid waste, asbestos, hazardous materials, or otherwise impacted soil. This assessment will be performed by the sub-contractor performing the work, and IRG Assumptions, LLC (IRGI) will provide oversight of such activities to assure that materials are handled properly. If such materials are encountered, the contractor will be responsible for containing, characterizing, and arranging transport of those materials to an appropriate disposal facility. Specific requirements pertaining to environmental monitoring, specimen containment, and disposal procedures are described in further detail below.

Additionally, no trenching or larger-scale excavations will be performed as part of this investigation. All IDW (soil, purge water, and decontamination water) will be containerized and characterized for disposal as out lined in the Cap Penetration Plan.

## 3.1 Geotechnical Borings

The initial geotechnical exploration will be conducted at thirty-eight (38) locations inside the environmental mitigation zone along the alignment of proposed utilities and roadways. The approximate borehole locations are shown in green on Figure 3. The geotechnical boreholes will be advanced to depths of approximately 12 feet below the existing grades. Final borehole depths will be determined in the field, as the subsurface profile becomes evident. Borings will be drilled utilizing a 4-inch, continuous-flight auger and a truck-mounted CME-55 drill rig. Geotechnical samples will be collected using a 2-inch diameter (O.D.) Standard split-spoon sampler or a 2.5-inch diameter (O.D.) modified California barrel sampler driven by blows of a 140 pound hammer falling 30 inches. Bulk samples may be collected from the cuttings at the discretion of the rig geologist. Geotechnical sampling will be collected with the initial sample being obtained below the low permeable layer (LPL). All borings will be advanced under the supervision of a qualified engineer/geologist who will log the boreholes in the field and prepare the geotechnical soil samples for transport to the contract geotechnical laboratory.

Samples collected will be returned to the contract laboratory where they will be visually examined and classified by an engineer and specific tests assigned. Laboratory tests will include dry density, moisture content, Atterburg limits, sieve analysis, and gradation.

If debris is observed in the borings or cuttings, the field geologist will collect and bag samples of the debris in order to conduct a visual assessment. If asbestos containing material (ACM) is suspected to be present in the debris, the field geologist will note the specific location and depth

of the sample for incorporation into the characterization report. The IRGI Oversight Coordinator will be notified for final assessment, appropriate handling, and disposal of the suspect material.

The field geologist will document all daily activities on a field log including, but not limited to, a detail of all Site activities, general observations, and the nature of any waste material encountered. All returns will be collected in s 55-gallon steel drum and characterized for disposal as described in the Cap Penetration Plan.

## 3.2 Subsurface Investigation Borings

Subsurface DPT borings are to be focused on defining the nature and extent of the trenches identified through aerial photographic analysis, evaluating subsurface conditions in areas identified for residential/commercial buildings, and to evaluate subsurface conditions in areas of potential grading and borrow source material. Continuous cores will be collected and logged by an onsite geologist utilizing DPT sampling methods. The borings will be advanced by continuous core DPT, using a new, clean disposable sample liner in an approximate 2.25-inch outer diameter, 4-foot-long core sampler at each borehole to collect samples to depth. All borings will be advanced under the supervision of a qualified engineer/geologist who will log the boreholes in the field. The field geologist will record a lithologic interpretation on the soil boring log.

A portion of the soil from each boring will be placed in a new, one quart ziplock® bag for headspace analysis utilizing a photoionization detector (PID) or a flame ionization detector (FID). PID/FID readings and corresponding depth intervals will also be noted on the log. If unusual staining, debris, odor, or elevated or readings are observed in any of these borings, it will also be described in detail in the field geologist's boring log.

It is not anticipated that environmental samples will be collected for chemical analyses from these boreholes (with the exception of soil to be screened for potential beneficial re-use). The presence or absence of landfill materials will be determined by both visual, PID/FID, and olfactory observation of the direct push returns. The actual number of test holes and their locations may vary slightly, depending on the anticipated dimensions of the trenches. The location of each boring will be staked and numbered. If refusal is encountered or if there is poor recovery such that an insufficient characterization can be made, a new borehole will be advanced and logged at an adjacent location and annotated in the field notes.

If debris is observed in the borings, the field geologist will collect and bag samples of the debris in order to conduct a visual assessment. If ACM is suspected to be present in the debris, the field geologist will note the specific location and depth of the sample for incorporation into the characterization report. The LAC Oversight Coordinator will be notified for final assessment, appropriate handling, and disposal of the suspect material.

Final borehole locations and depths will be determined in the field, as the subsurface profile becomes evident. All returns will be collected in s 55-gallon steel drum and characterized for disposal as directed in the Cap Penetration Plan.

### 3.2.1 Subsurface Borings to Evaluate/Confirm Trench Locations

Approximately one hundred forty-three (143) boreholes for shallow environmental exploration will be advanced to confirm the locations of trenches identified during aerial photographic analysis shown in orange on Figure 2. The boreholes will be advanced to varying depths below the existing grades to locate trench waste and identify clean or native soil.

The following criteria will be applied to determine if offset borings are necessary to locate the trench locations:

- If no waste is encountered to at least 15 feet bgs, then a second borehole will not be advanced outside the previous boring
- If waste is encountered in the initial borehole, the drilling will stop and a second borehole located approximately 10 feet outside the previous boring perpendicular to the orientation of the trench will be advanced to the maximum depth of 15 feet or until waste is encountered
- If waste is encountered in the offset borehole, then a third borehole located approximately 10 feet outside the previous boring perpendicular to the orientation of the trench will be advanced to the maximum depth of 15 feet or until waste is identified

### 3.2.2 Borings to Evaluate Potential Redevelopment Areas

Sixty (60) borings will be advanced in areas inside the environmental mitigation zone to visually characterize the subsurface soil beneath areas identified for future redevelopment as potential residential and commercial building footprints shown in blue on Figure 3. These borings will be advanced to a maximum depth of 15 feet below ground surface (bgs), to determine the potential for waste to be present under proposed commercial and residential buildings. Borings will be advanced until waste is encountered, or auger refusal is encountered, or the borehole reaches 15 feet bgs, whichever occurs first.

### 3.2.3 Borings to Evaluate Soil in Proposed Grading Areas

The northern portion of the Site has been identified as a potential borrow source during initial planning of site grading. An additional fifty-three (53) shallow borings will be advanced in areas inside of the environmental mitigation zone on the northern portion of the site to visually characterize the subsurface soils in proposed grading areas shown in purple on Figure 3. This soil will also be assessed for beneficial re-use as fill material for future redevelopment. These borings

will be advanced to 3 feet below the proposed rough grading for the site. Up to 10 composite samples may be collected for chemical analysis from these shallow borings to determine the viability for beneficial re-use.

### 3.2.4 Potential Soil Sampling for Beneficial Re-use

One aliquot from each boring where the subsurface soil visually appears non-contaminated will be collected from the upper five feet and composited into one sample for a group of five regionally significant borings outlined with grey lines on Figure 3. This composite sample will be homogenized in a clean one-gallon ziplock® bag. A single sample will be collected from this composite and placed in laboratory-provided sample jars, labeled, and placed on ice in a cooler for shipment to the laboratory under chain-o-custody (COC) protocols. This composite sample will be analyzed to document the conditions of the soil for potential beneficial re-use. Composite samples will be analyzed for semi-volatile organic compounds (SVOCs) by EPA Method 8270, and for volatile organic compounds (VOCs) by EPA Method 8260B, RCRA 8 Metals, and gasoline range organics (GRO) and diesel range organics (DRO) by EPA Method 8015B. One field duplicate sample will also be collected for analysis.

Discrete soil samples may also be selected for chemical analysis and will be containerized directly out of the liner using a new, clean disposable tool. Soil samples will be placed in laboratory-provided sample jars, labeled, and placed on ice in a cooler for shipment to the laboratory under COC protocols. Samples will be analyzed for SVOCs by EPA Method 8270, and for VOCs by EPA Method 8260B, RCRA 8 Metals, and GRO and DRO by EPA Method 8015B.

### 3.2.5 Documentation

The field geologist will document all daily activities on a field log including, but not limited to, a detail of all Site activities, general observations, and the nature of any waste material encountered. The original field logs will be maintained in IRGI's project files, and copies will be provided as an attachment to the final site report. The field log will consist of the field geologist's bound field notebook.

Lithology will be documented in accordance with American Society for Testing & Materials (ASTM) D-2488-90 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) (ASTM, 1990). Additional information will be recorded on Lithologic Log for each boring including the borehole location; drilling information; sampling information such as sample intervals, recovery, field parameters; and sample description information. Descriptive information to be recorded in the field will also include:

- Identification of the predominant particles size and range of particle sizes;
- Percent of gravel, sand, fines, or all three;
- Description of grading and sorting of coarse particles;
- Particle angularity and shape;
- Maximum particle size or dimension;
- Plasticity of fines;
- Color (using Munsell Color System);
- Moisture (dry, wet, or moist);
- Consistency of fine grained soils;
- Structure of consolidated materials;
- Cementation (weak, moderate, or strong); and
- Identification of the Unified Soil Classification System (USCS) group symbol.

Additional information to be recorded includes the depth to the water table, caving or sloughing of the borehole, changes in drilling rate, presence of organic materials, presence of fractures or voids in consolidated materials, and other noteworthy observations or conditions, such as the locations of geologic boundaries.

## 3.3 Soil Gas Survey

The objectives of the soil gas sampling for the Site are as follows:

- Define current conditions in the vadose zone below the OU2 Landfill cap where waste trenches have been identified and residential or commercial construction is planned
- Provide data necessary to target potential soil gas mitigation needs in the investigation area
- Evaluate potential soil gas migration pathways

These objectives will be met through installation and sampling of up to twenty-eight (28) soil gas probes at varying depths above trench locations as shown in magenta on Figure 3. This will be a one-time sampling event to characterize soil gas conditions at the Site and augment the existing soil gas data set from the six years of post-closure monitoring.

### 3.4.1 Soil Gas Probe Installation

Using direct push methods, a continuous core will be collected to first identifiable waste or a depth of at least ten feet bgs to identify potential soil gas above identified waste trenches. The deepest soil gas probe will be installed just above the waste/fill interface and is anticipated to represent the worst case, or highest potential concentration of soil gas. Target depths are approximately 8 feet bgs; however, these depths will be adjusted based on lithology and depth to waste to best define the concentrations within the soil column. After the soil gas sampling location is cored, a small diameter sampling tube (1/4 inch) with a gas sampling probe tip will be installed. The pre-assembled probe tip and tubing will be placed through the drive casing and

suspended while the sand pack is placed. The sand pack will placed by pouring sand directly through the casing. One foot of granular bentonite will be placed above the sand pack, followed by hydrated medium bentonite chips to the ground surface. A gas-tight fitting will be installed at the top of the sampling tube no more than 6 inches above the surrounding grade.

### 3.4.2 Preferred Leak Test Method

Soil vapor samples will be collected in the field using current state of the art procedures and soil vapor probes will not be disturbed for at least 24 hours before sampling. During soil vapor sampling activities, a clean, small plastic or stainless steel shroud with two small ports will be placed over each soil vapor probe and weighted down. An air-tight seal of hydrated bentonite or foam will be placed on the ground surface around the edge of the shroud where it contacts the ground. The soil vapor probe tube, which is fitted with an air-tight valve, will be extended up through the air-tight seal of hydrated bentonite or foam to the exterior side of the shroud. If required, the probe tubing will be extended above ground surface with an additional piece of Nylaflow® tubing. All connections will be located inside the shroud to verify that the seals are air-tight. Each soil vapor tube, connected to an air-tight valve, will be connected with a tedlar bag attached to one side of the valve and the sampling tube on the other side of the valve (both outside of the shroud). Prior to purging or sampling activities, helium tracer gas will be released via a small diameter tube through a port in the shroud into the enclosure beneath the shroud. A sample of the air inside the shroud will be measured through the second port using a portable helium detector to determine the concentration of helium within the enclosure beneath the shroud. Each soil vapor probe will have approximately 1.0 liter purged, at a flow rate of 0.1 liters per minute, into a tedlar bag. The tedlar bag will then be connected to a portable helium detector to measure for the presence of helium gas in the purged vapor. If high concentrations (>10% of the shroud concentration) of helium are observed in the purge vapor, the soil vapor probe seal and shroud seals will be checked and/or enhanced to reduce the infiltration of ambient air into the enclosure and another sample collected. If helium concentrations are less than 10% of the shroud concentration, a soil vapor sample will be collected for analysis.

### 3.4.2 Soil Gas Sample Collection

Soil gas samples will be collected from the temporary soil gas points, at each of 28 locations shown in magenta on Figure 3. All temporary soil gas points will be inspected for damage and cleaned with a clean paper towel prior to sampling. The purpose of these samples is to define the concentrations of the contaminants of interest (COIs) in soil gas in areas overlying areas designated for residential development.

For each soil gas sample, new tubing will be connected with a three-way valve to a sample pump, a Tedlar® purge bag, and a sample canister. Approximately one liter of air will be purged from

the soil gas monitoring point. Following the purge, a sample will be collected for analysis, using a one-liter SUMMA®-passivated or Silco® stainless steel canister. Each sampling system will consist of a canister and a dedicated flow controller or critical orifice. The analytical laboratory will preset the dedicated flow controller/critical orifice for each sample canister to a nominal 100 to 200 milliliter per minute (ml/min) flow rate.

Soil gas samples will be collected in the canisters as composite sub-atmospheric samples over a nominal five (5) to ten (10) minute time period. A duplicate soil gas sample will be collected each day that samples are collected. Each complete sampling system will be certified for acceptable blank levels of COIs prior to shipment by the laboratory. Each canister will be evacuated to a nominal 29 to 30 inches of. Mercury (Hg), sealed, and shipped to the field under chain-of-custody documentation. The vacuum will be noted and recorded in the field at the beginning and end of each sampling event.

### 3.4.3 Laboratory Analysis

All soil gas samples will be analyzed using a modified Method TO-15 (USEPA, 1999a) and the contract laboratory standard operating procedures (SOPs). A (GC/MS) operated in the SCAN mode (GC/MS-SCAN) will be used to quantify concentrations of COIs in the collected samples. Specific analytical procedures are described below.

The laboratory reporting limits are initially established for an undiluted laboratory standard. When a sub-atmospheric integrated sample is collected, the canister does not fill completely. A diluent gas is added to pressurize the canisters for analysis. Consequently, sample reporting limits can vary for each sample, depending on sample volume and sample matrix effects (Table 3.4.3).

**Table 3.4.3 Sample Reporting Limits for Air Samples**

| Volatile Organic Compound | Sample Reporting Limits (µg/m$^3$) | Screening Level* Target Risk | Screening Level* Hazard Index |
|---|---|---|---|
| Vinyl Chloride | 0.030 – 0.042 | 0.16 | 100 |
| 1,1-Dichloroethene (1,1-DCE) | 0.030 – 0.042 | | 210 |
| Trichloroethene (TCE) | 0.012 – 0.017 | 1.6** | |
| Tetrachloroethene (PCE) | 0.030 – 0.042 | 0.41 | 280 |
| Cis-1,2-Dichloroethene (cis-1,2-DCE) | 0.030 – 0.042 | | |
| trans-1,2-Dichloroethene (trans-1,2-DCE) | 0.030 – 0.042 | | 63 |
| 1,1-Dichloroethane (1,1-DCA) | 0.030 – 0.042 | 1.5 | |

| | | | |
|---|---|---|---|
| 1,2-Dichloroethane (1,2-DCA) | 0.030 – 0.042 | 0.094 | |
| 1,1,1-Trichloroethane (1,1,1-TCA) | 0.030 – 0.042 | | 5200 |
| 1,1,2-Trichloroethane (1,1,2-TCA) | 0.030 – 0.042 | 0.15 | |

Source: USEPA Regions 9, 6, and 3 Regional Screening Levels for Chemical Contaminants at Superfund Sites http://www.epa.gov/reg3hwmd/risk/human/rbconcentration_table/Generic_Tables/xls/resair_sl_table_run_12SEP2008.xls **CDPHE, 2004

In addition to the above analysis, methane will be measured and analyzed in each of the 28 gas monitoring probes.

*Field Quality Assurance / Quality Control*

Field QA/QC will consist of daily reviews of field activities to assess whether work was performed in accordance with this work plan. If deviations from this work plan are noted, they will be evaluated to assess the impact on the data collected. Analytical results of QC samples will be evaluated as soon as they are available. If results indicate there is contamination in the blanks, field practices will be reevaluated. Corrective actions will be implemented where practicable and the deviation and corrective action will be recorded.

*Sample Chain of Custody Forms*

A chain-of-custody form will accompany all samples to the designated laboratory. The following minimum information concerning the sample will be documented on the COC forms:

- Unique sample identification;
- Date and time of sample collection;
- Sample location identification;
- Sample matrix;
- Preservative used (if any);
- Analyses requested;
- Custody transfer signatures and dates and times of sample transfer; and
- Bill of lading or transporter tracking number (if applicable).

# 4.0 Data Evaluation and Reporting

All data resulting from this investigation will be presented in a written report. The report will consist of a presentation of the raw analytical data, summaries of the review and verification effort, as appropriate, as well as interpretative findings relative to the data and observations.

Reports will contain final results, analytical methods, detection limits, method blank data, and results of QC samples (where applicable). In addition, special analytical problems

and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Data are normally reported in units commonly used for the analyses performed.

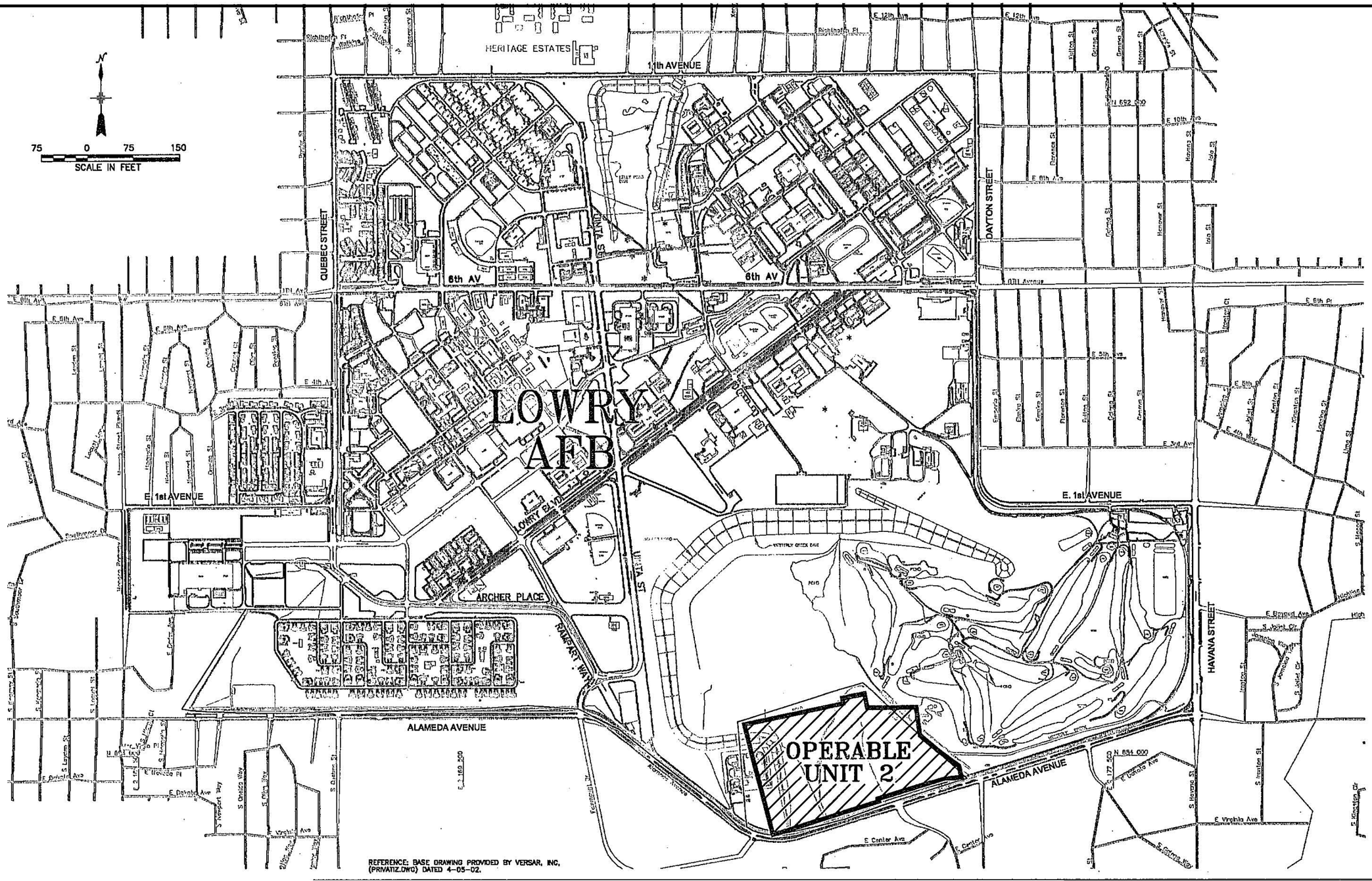
The final data report provided by the laboratories will include:

- Cover page/laboratory chronicle;
- Chain-of-custody sample request form;
- Sample data (including QC sample) results; and
- Case narrative describing data qualifiers, sample collection, sample preparation and analysis dates, and a description of any technical problems encountered with the analysis.

QC results include a method blank and laboratory control samples (LCSs). Sample data results, including QC sample results, will also be delivered in an electronic format. Laboratories are responsible for reviewing the electronic deliverable to ensure that the electronic data matches the hard copy reports.

The Project Manager will ensure that a review of observation and analytical data is performed. The purpose of analytical data review is to eliminate unacceptable data and to qualify data for any data quality limitations identified during review. In addition to the laboratory QA review, all data deliverables will be evaluated, at a minimum, for the following:

- Compliance with requested testing;
- Completeness of analytical report; and
- Confirmation of receipt of all requested deliverables.




IRG

**Figure 1**
**Lowry Vista / OU2**
**Subsurface Investigation Work Plan**
**Former Lowry Air Force Base**
**IRG– Assumptions, LLC**

## AREA LEGEND

| LOT # | SQUARE FT. | ACRES |
|---|---|---|
| LOT 1 | 76,642 SF | 1.76 AC |
| LOT 2 | 64,593 SF | 1.48 AC |
| LOT 3 | 51,278 SF | 1.18 AC |
| LOT 4 | 48,283 SF | 1.11 AC |
| LOT 5 | 44,990 SF | 1.03 AC |
| LOT 6 | 45,466 SF | 1.04 AC |
| LOT 7 | 183,099 SF | 4.20 AC |
| LOT 8 | 68,369 SF | 1.57 AC |
| LOT 9 | 44,998 SF | 1.03 AC |
| LOT 10 | 38,769 SF | 0.89 AC |
| LOT 11 | 53,143 SF | 1.22 AC |
| LOT 12 | 68,860 SF | 1.58 AC |
| ANCHOR 1 | 656,450 SF | 15.07 AC |
| MULTI-FAMILY | 708,721 SF | 16.27 AC |
| TOTAL | 2,153,170 SF | 49.43 AC |

## LEGEND

- PROJECT BOUNDARY / PROPERTY LINE
- PROPOSED LOT LINES
- PROPOSED CURB AND GUTTER
- EXISTING EDGE OF PAVEMENT
- EXISTING CURB AND GUTTER
- EXISTING CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- APPROXIMATE TRENCH LOCATIONS
- BUILDING FOOTPRINT
- EXISTING GRADE DOUBLE 500-YR. FLOOD CONTOUR LINE

MULTI FAMILY LOT
752,704 SF
17.28 ACRES

LOT 11
53,144 SF
1.22 ACRES

ANCHOR 1 LOT
656,230 SF
15.07 ACRES

LOT 10
39,028 SF
0.90 ACRES

WEST LOT
383,895 SF
8.81 ACRES

LOT 9
45,000 SF
1.03 ACRES

LOT 8
93,196 SF
2.14 ACRES

LOT 7
182,661 SF
4.19 ACRES

LOT 6
45,497 SF
1.04 ACRES

LOT 5
44,988 SF
1.03 ACRES

LOT 4
48,264 SF
1.04 ACRES

LOT 3
51,112 SF
1.17 ACRES

LOT 2
64,578 SF
1.48 ACRES

LOT 1
76,853 SF
1.76 ACRES

ALAMEDA AVE

NORTH 100 0 50 100
SCALE: 1" = 100'

## EARTHWORK

OVERALL SITE
CUT 116,400 CU. YD
FILL 430,000 CU. YD
**NET 313,600 CU. YD**

MULTI-FAMILY SITE
CUT 0 CU. YD
FILL 118,000 CU. YD
**NET 118,000 CU. YD**

MAJOR ANCHOR SITE
CUT 0 CU. YD
FILL 147,000 CU. YD
**NET 147,000 CU. YD**

WEST SIDE PARCEL
CUT 0 CU. YD
FILL 60,000 CU. YD
**NET 60,000 CU. YD**

COMMERCIAL FRONTAGE
CUT 400 CU. YD
FILL 76,700 CU. YD
**NET 76,300 CU. YD**

FIRE STATION
CUT 0 CU. YD
FILL 14,300 CU. YD
**NET 14,300 CU. YD**

COMMON AREA (POND)
CUT 116,000 CU. YD
FILL 14,000 CU. YD
**NET (102,000) CU. YD**

COMPENSATORY VOLUME
CUT 102,000 CU. YD
FILL 121,000 CU. YD
**NET (19,000) CU. YD**

## CAP

CAP AREA
64.25 AC

INTRUSION INTO CAP
77,400 CU. YD

INTRUSION INTO CAP IN COMMON AREA
77,000 CU. YD

INTRUSION INTO CAP IN ROAD AREAS
7,200 CU. YD

PERCENT OF INTRUSION INTO CAP IN ROAD AREAS
9.3%

PERCENT OF INTRUSION INTO WASTE TRENCH IN ROAD AREAS
0.04%

CLC ASSOCIATES
8480 E. ORCHARD RD.
SUITE 2000
GREENWOOD VILLAGE
COLORADO 80111
P 303 770 5600
F 303 770 2349
CLCASSOC.COM

ARCHITECTURE
ENGINEERING PLANNING
LANDSCAPE ARCHITECTURE
LAND SURVEYING

SITE PLAN FOR
# LOWRY VISTA
ALAMEDA AVE. & S. DAYTON ST.
DENVER, COLORADO

DESCRIPTION
CDPHE EXHIBIT

DATE
10/22/12

PROJECT #: 12.0053
DRAWN BY: LMC
DESIGNED BY: MEJ
CHECKED BY: TDW

# OVERALL SITE PLAN-CDPHE EXHIBIT

FIGURE 2

## AREA LEGEND

| LOT # | SQUARE FT. | ACRES |
|---|---|---|
| LOT 1 | 76,642 SF | 1.76 AC |
| LOT 2 | 64,593 SF | 1.48 AC |
| LOT 3 | 51,278 SF | 1.18 AC |
| LOT 4 | 48,283 SF | 1.11 AC |
| LOT 5 | 44,990 SF | 1.03 AC |
| LOT 6 | 45,466 SF | 1.04 AC |
| LOT 7 | 183,099 SF | 4.20 AC |
| LOT 8 | 68,369 SF | 1.57 AC |
| LOT 9 | 44,998 SF | 1.03 AC |
| LOT 10 | 38,769 SF | 0.89 AC |
| LOT 11 | 53,143 SF | 1.22 AC |
| LOT 12 | 68,860 SF | 1.58 AC |
| ANCHOR 1 | 656,450 SF | 15.07 AC |
| MULTI-FAMILY | 708,721 SF | 16.27 AC |
| TOTAL | 2,153,170 SF | 49.43 AC |

## BORE LOCATIONS LEGEND

- PROPERTY BOUNDARY
- (60) FA # — BORING LOCATIONS IN FILL AREAS
- (53) CA # — BORING LOCATIONS IN CUT AREAS (BB=BOTTOM OF BORE) (3' DEPTH BELOW ROUGH GRADE UNLESS OTHERWISE NOTED) (D = DEPTH OF BORE)
- (143) TC #'s — BORING LOCATIONS @ TRENCH CORNERS
- (28) SG # — BORING & SAMPLING POINT
- (38) GT # — GEOTECHNICAL BORING LOCATIONS (10' DEPTH BELOW EXISTING GRADE)
- COMPOSITE SAMPLE AREA FROM GROUP OF FIVE BORING LOCATIONS

## LEGEND

- PROJECT BOUNDARY / PROPERTY LINE
- PROPOSED LOT LINES
- PROPOSED CURB AND GUTTER
- EXISTING EDGE OF PAVEMENT
- EXISTING CURB AND GUTTER
- EXISTING CONTOUR
- 2525 PROPOSED MAJOR CONTOUR
- 2525 PROPOSED MINOR CONTOUR
- APPROXIMATE TRENCH LOCATIONS
- BUILDING FOOTPRINT
- EXISTING GRADE DOUBLE 500-YR. FLOOD CONTOUR LINE

MULTI FAMILY LOT
752,704 SF
17.28 ACRES

LOT 11
53,144 SF
1.22 ACRES

ANCHOR 1 LOT
656,230 SF
15.07 ACRES

LOT 10
39,028 SF
0.90 ACRES

WEST LOT
383,895 SF
8.81 ACRES

LOT 9
45,000 SF
1.03 ACRES

LOT 8
93,196 SF
2.14 ACRES

LOT 7
182,661 SF
4.19 ACRES

LOT 6
45,497 SF
1.04 ACRES

LOT 5
44,988 SF
1.03 ACRES

LOT 4
48,264 SF
1.04 ACRES

LOT 3
51,112 SF
1.17 ACRES

LOT 2
64,578 SF
1.48 ACRES

LOT 1
76,853 SF
1.76 ACRES

ALAMEDA AVE

NORTH 100 0 50 100
SCALE: 1" = 100'

## EARTHWORK

| | |
|---|---|
| OVERALL SITE | |
| CUT | 116,400 CU. YD |
| FILL | 430,000 CU. YD |
| **NET** | **313,600 CU. YD** |
| MULTI-FAMILY SITE | |
| CUT | 0 CU. YD |
| FILL | 118,000 CU. YD |
| **NET** | **118,000 CU. YD** |
| MAJOR ANCHOR SITE | |
| CUT | 0 CU. YD |
| FILL | 147,000 CU. YD |
| **NET** | **147,000 CU. YD** |
| WEST SIDE PARCEL | |
| CUT | 0 CU. YD |
| FILL | 60,000 CU. YD |
| **NET** | **60,000 CU. YD** |
| COMMERCIAL FRONTAGE | |
| CUT | 400 CU. YD |
| FILL | 76,700 CU. YD |
| **NET** | **76,300 CU. YD** |
| FIRE STATION | |
| CUT | 0 CU. YD |
| FILL | 14,300 CU. YD |
| **NET** | **14,300 CU. YD** |
| COMMON AREA (POND) | |
| CUT | 116,000 CU. YD |
| FILL | 14,000 CU. YD |
| **NET** | **(102,000) CU. YD** |
| COMPENSATORY VOLUME | |
| CUT | 102,000 CU. YD |
| FILL | 121,000 CU. YD |
| **NET** | **(19,000) CU. YD** |

## CAP

CAP AREA
64.25 AC

INTRUSION INTO CAP
77,400 CU. YD

INTRUSION INTO CAP IN COMMON AREA
77,000 CU. YD

INTRUSION INTO CAP IN ROAD AREAS
7,200 CU. YD

PERCENT OF INTRUSION INTO CAP IN ROAD AREAS
9.3%

PERCENT OF INTRUSION INTO WASTE TRENCH IN ROAD AREAS
0.04%

CLC ASSOCIATES
8480 E. ORCHARD RD.
SUITE 2000
GREENWOOD VILLAGE
COLORADO 80111
P 303 770 5600
F 303 770 2349
CLCASSOC.COM

ARCHITECTURE
ENGINEERING PLANNING
LANDSCAPE ARCHITECTURE
LAND SURVEYING

SITE PLAN FOR
**LOWRY VISTA**
ALAMEDA AVE. & S. DAYTON ST.
DENVER, COLORADO

DESCRIPTION
CDPHE EXHIBIT

DATE
10/22/12

# OVERALL SITE PLAN-CDPHE EXHIBIT

PROJECT #: 12.0053
DRAWN BY: LMC
DESIGNED BY: MEJ
CHECKED BY: TDW

FIGURE 3

**ATTACHMENT C**

SECTION 02921

SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

For disturbed areas to be vegetated as indicated on the Drawings, provide seed as specified herein. Furnish and place vegetative layer material, lime, compost, seed, and mulch in the areas indicated, and maintain new seeding through the contract maintenance period.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02315: Earthwork

B. Section 02261: Diversion Berms and Erosion Control Matting

C. Section 02370: Erosion and Sedimentation Control

1.3 SUBMITTALS

Submit the following in accordance with Section 01330: “Submittal Procedures”.

A. Grass Seed Vendor’s Certificate:

Submit the seed vendor’s certified statement for the grass seed mixture required, showing common name, percentage of seed mix by weight, percentages of purity and germination, year of production, date of packaging, and location of packaging.

B. Compost:

Submit the compost manufacturer’s product data showing suitability for specified seeding.

C. Hydraulic Seeding Method:

If the Hydraulic Seeding Method is used, submit a certified statement as to the number of pounds of materials to be used per 100 gallons of water, and specify the number of square feet of seeding that can be covered with the quantity of solution in the hydroseeder.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

Obtain and retain as part of the project records, certifications, and/or labels of materials supplied.

B. Vegetative Layer Material:

See Section 02315: "Earthwork".

C. Compost:

Fertilizer is not required. In lieu of fertilizer, add an Engineer – approved, quality compost before seeding.

D. Lime:

Ground limestone composed of not less than 85 percent calcium and magnesium carbonates and to not less than 40 percent calcium and magnesium oxides; at least 85 percent shall pass a No. 10 mesh screen and 50 percent shall pass a No. 40 mesh screen.

E. Seed:

Shall meet the following minimum requirements:

1. The grass seed mixture shall include no "primary noxious weed seeds."
2. Furnish in fully-labeled, standard sealed containers.
3. Percentage and germination of each seed type in the mixture, purity, and weed seed content of the mixture shall be clearly stated on the label.
4. Subject to the testing provisions of the USDA, with the month and year of test clearly stated on the label.
5. Seed which has become wet, moldy, or otherwise damaged will not be acceptable.
6. Use seed mixtures as specified below:

| Species | Variety | % of Mix | PLS #/ac Drilled | PLS #/ac Broadcast |
|---|---|---|---|---|
| Western wheatgrass | Arriba | 20 | 3.2 | 6.4 |
| Sideoats grama | Vaughn | 20 | 1.8 | 3.6 |
| Blue Grama | Hachita | 20 | 0.6 | 1.2 |
| Prairie junegrass | native | 15 | 0.2 | 0.3 |
| Sandberg bluegrass | native | 15 | 0.5 | 0.9 |
| Sheep fescue | Covar | 10 | 0.4 | 0.8 |
| TOTALS | | 100 | 6.7 #/ac | 13.2 #/ac |

7. Other suitable seed mix is acceptable if approved by the Engineer and is recommended by the local office of the Natural Resources Conservation Service (NRCS).
8. For temporary seeding requirements see Section 02370: "Erosion and Sedimentation Control".

F. Mulch:

1. Straw or hay – unrotted air dried, small grain straw, salt hay, or hay free from noxious weeds or undesirable seeds and coarse material.
2. Wood Cellulose Fiber – having no growth or germination inhibiting materials.

G Binders for Mulch:

Binders for straw or hay mulch shall consist of emulsified asphalt, organic and vegetable based gels, synthetic plastic emulsion, or fiber mulch as approved by the NRCS.

H. Erosion Control Blankets:

See Section 02370: "Erosion and Sedimentation Control" for temporary matting which may be used for mulching.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. All Areas to be Seeded:

1. Shall be worked with a disk, harrow, dragged with a chain, mat or blade, machine-raked, or hand-worked as necessary to provide a reasonably firm but friable seedbed.
2. Shall meet the specified grades and are free of growth and debris.
3. Take care to prevent the formation of low places and pockets where water will stand.

B. Depth of Tillage:

1. Provide minimum of 2 inches for all applications.
2. On slopes steeper than 3:l, reduce depth of tillage to 1 inch.
3. Where rye grass has been planted for temporary erosion control and has not been eliminated prior to the completion of the work, disk at least 4 inches deep and seed to permanent grasses.

### 3.2 APPLICATION

A. Vegetative Layer Soil:

Vegetative Layer soil shall be placed using earth moving equipment. The soil shall be spread in a minimum uniform loose depth of six (6) inches and compacted. The soil shall not be worked when it is in a saturated state. The soil surface shall be left free of ruts or channels. Remove all large stiff clods, lumps, brush, roots, stumps, litter, and other foreign material and stones over 2-inch in size. See Section 02315: "Earthwork" for additional requirements.

B. Compost and Lime:

1. Apply by means of a mechanical spreader or other acceptable method which is capable of maintaining a uniform rate of application.
2. Conduct when the soil is in a moist condition and at least 24 hours before sowing the seed.
3. Compost shall be applied at the rate based on the results of the nutrient analysis tests or when nutrient analysis is not provided apply at a minimum rate of 500 pounds per acre with 50% water insoluble nitrogen.

4. Lime shall be applied at the rate based on the results of the soil tests. When testing is not provided apply at a minimum rate of 2 tons per acre.

C. Seeding:

1. Seed mixture shall be applied at the rate identified in Paragraph 2.1.E.

2. Perform erosion control items of work such as seeding and mulching upon completion of a unit or portion of the project. Optimum seeding dates are 3/1 to 4/30 and 8/15 to 10/15. When weather and soil conditions are suitable, other seeding times may be acceptable as approved by the Engineer.

3. When immediate protection of newly graded areas is necessary at a time which is outside of the normal seeding season, apply hay, straw or other approved mulch with the seeding done at the same time or done later, or both, as ordered.

4. When immediate seeding is required on areas of the project which are not to be regraded or disturbed, use specified seed mixture.

5. Areas of the project which are to be left temporarily and which will be regraded or otherwise disturbed later during construction may be ordered to be seeded with temporary seed mix as required in Section 02370: "Erosion and Sedimentation Control".

6. Special care must be taken during the hot dry periods from June to mid to late August. Do not seed during windy weather or when the ground is frozen, excessively wet, or otherwise untillable.

D. Mulch:

1. Undertake immediately after each area has been properly prepared.

2. Apply hay or straw unless otherwise protected with erosion control blankets that has been thoroughly fluffed at approximately, but not to exceed, 3 tons per acre when a crimper is used and at a rate of 1-1/2 to 2 tons per acre when a liquid mulch binder is used.

3. Blowing chopped mulch will be permitted when authorized.

4. Authorization will be given when it can be determined that the mulch fibers will be of such length and applied in such a manner that there will be a minimum amount of matting that would retard the growth of plants.

5. Hay or straw mulch should cover the ground enough to shade it, but the mulch should not be so thick that a person standing cannot see ground through the mulch.

6. Remove matted mulch or bunches.

7. Dispose of all baling wire or rope outside the limits of the project in approved areas.

## 3.2 SEEDING METHODS

A. General:

Compost, limestone, mulch material if required, and seed of the type specified may be placed at the locations shown or ordered by one of the following methods, provided an even

distribution is obtained. The maximum seeding depth shall be 1/4-inch when using methods other than hydroseeding.

B Dry Method:

1. Power Equipment: Use mechanical seeders, seed drills, landscape seeders, cultipacker seeders, compost spreaders, or other approved mechanical seeding equipment or attachments when seed, limestone, and compost are to be applied in dry form.
2. Manual Equipment: On areas which are inaccessible to power equipment, permission may be given to use hand-operated mechanical equipment when the materials are to be applied in dry form. The use of hand shovels to spread the materials will not be allowed.
3. Do not mix limestone and compost together prior to their application, but work into the soil together to the specified depth.
4. After seeding, compact the entire area by a suitable roller weighing 60 to 90 lbs. per lineal foot.
5. Allow at least 24 hours between composting and seeding.
6. Unless otherwise ordered, mulch areas covered with seed.

C. Hydraulic Method:

1. The application of grass, seed, compost, limestone, and a suitable mulch, if approved, may be accomplished in one operation by the use of an approved spraying machine.
2. Mix materials with water in the machine and keep in an agitated state in order that the materials may be uniformly suspended in the water.
3. The spraying equipment shall be so designed that when the solution is sprayed over an area, the resulting deposits of limestone, compost, and grass seed are equal in quantity to the required rates.
4. Flush and clean hydraulic seeding and composting machine each day before seeding is to be started, and thoroughly flush of all residue after the completion of application on every 10 acres.
5. If the results of the spray operations are unsatisfactory, abandon this method and apply the materials by the dry method.
6. When inoculum is required, mix with the seed and spray.
7. Compaction or rolling not required.
8. Unless mulch material required is applied during the seeding operation or within 1/2 hour following the seeding operation, take measures to protect the seed from sunlight and heat such as the use of a light brush dragged over the seeded areas to stir the seed into the soil, taking care not to carry the seed ahead.

## 3.4 CARE AFTER SEEDING (MAINTENANCE)

A. Protection:

Protect and care for seeded areas until final acceptance of the work, and repair any damage to seeded areas caused by pedestrian or vehicular traffic or other causes. If necessary, place barricades and suitable signs to protect the seeded areas.

Control weeds during establishment either through mechanical or chemical means. Once grass is established, mow once or twice a year at a height of 4 inches.

B. Water:

Apply water to maintain proper moisture to promote growth and/or as directed by the Engineer. Use approved water wagons or tanks or other approved devices to apply water in the form of a spray or sprinkle without erosive force. Apply water prior to 10:00 a.m. and after 4:00 p.m. to minimize losses due to evaporation.

C. Acceptance:

To be acceptable, a stand of grass shall show a reasonably thick, uniform stand, free from sizable areas of thin or bare spots, with a minimum coverage of approximately 80 percent.

D. Reseed:

Any parts of seeded areas which fail to show a uniform stand, reseed until all areas are covered with acceptable grass growth.

E. Maintenance Period:

This period shall extend until to end of the contract warranty period or once the area is completed and accepted by the Owner. During this period do all necessary mowing to keep the grass between 5 and 8 inches in height.

-- END OF SECTION --

**Table 12**
**Summary of Revegetation Seed Data**
**OU 2 Landfill Closure at Lowry**

| Seed Type (Variety) (from seed tag) | % Pure Seed/Acre (from seed tag) | Total lbs/Acre (% Pure x Net Wt) | % Germination (from seed tag) | PLS lbs/Acre (Total lbs x % Germ) | Specified PLS lbs/Acre (from Spec 02921) | Ratio of Actual to Specified (Actual / Specified) |
|---|---|---|---|---|---|---|
| Western Wheatgrass (Arriba) | 38.99% | 11.17 | 86% | 9.60 | 3.2 | 3.0 |
| Sideoats Grama (Vaughn) | 20.50% | 5.87 | 92% | 5.40 | 1.8 | 3.0 |
| Blue Grama (Hachita) | 6.76% | 1.94 | 93% | 1.80 | 0.6 | 3.0 |
| Prairie Junegrass (VNS) | 2.23% | 0.64 | 94% | 0.60 | 0.2 | 3.0 |
| Sandberg Bluegrass (VNS) | 6.24% | 1.79 | 84% | 1.50 | 0.5 | 3.0 |
| Sheep Fescue (Covar) | 4.66% | 1.33 | 90% | 1.20 | 0.4 | 3.0 |
| Winter Wheat | 10.38% | 2.97 | 97% | 2.88 | Not Specified | Not Applicable |
| **SubTotal** | **89.76%** | **25.71** | | **22.99** | **6.70** | **3.4** |
| Crop | 0.25% | 0.07 | | | | |
| Inert | 9.91% | 2.84 | | | | |
| Weeds | 0.08% | 0.02 | | | | |
| Noxious Weeds | 0.00% | 0.00 | | | | |
| **Total (calculated)** | **100.00%** | **28.64** | | **22.99** | **6.70** | |
| Net Weight/Acre (lbs, from seed tag) | | 28.64 | | | | |
| PLS lbs/Acre (from seed tag) | | | | 22.98 | | |

PLS = Pure Live Seed
lbs = Pounds
% = Percent

This table obtained from Completion Report for the Operable Unit 2 Landfill Closure at Lowry prepared by MACTEC and dated March 2005.

**ATTACHMENT D**

# MATERIAL SPECIFICATION

# SC250

The composite turf reinforcement mat (C-TRM) shall be a machine-produced mat of 70% straw/30% coconut fiber matrix incorporated into a permanent three-dimensional turf reinforcement matting.

The matrix shall be evenly distributed across the entire width of the matting and stitch bonded between a heavy duty UV stabilized bottom net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, an ultra heavy duty UV stabilized, dramatically corrugated (crimped) intermediate netting with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings, and covered by a heavy duty UV stabilized top net with 0.50 x 0.50 inch (1.27 x 1.27 cm) openings. The middle corrugated netting shall form prominent closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together on 1.50 inch (3.81 cm) centers with UV stabilized polypropylene thread to form a permanent three-dimensional turf reinforcement matting.

The SC250 shall meet requirements established by the Erosion Control Technology Council (ECTC) Specification and the U.S. Department of Transportation, Federal Highway Administration's (FHWA) *Standard Specifications For Construction of Roads and Bridges on Federal Highway Projects, FP-03 2003 Section 713.18* as a *Type 5A, B, and C Permanent Turf Reinforcement Mat*.

Installation staple patterns shall be clearly marked on the turf reinforcement mattings with environmentally safe paint. All mats shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats.

The composite turf reinforcement mat shall be the North American Green SC250, or equivalent. The SC250 permanent composite turf reinforcement mat shall have the following physical properties:

**Material Content**

| | |
|---|---|
| Matrix | 70% Straw Fiber<br>(0.35 lb/yd$^2$) (0.19 kg/m$^2$)<br>30% Coconut Fiber<br>(0.15 lb/yd$^2$) (0.08 kg/m$^2$) |
| Netting | Top and Bottom – Heavy Duty UV Stabilized Polypropylene<br>(5.0 lbs/1,000 ft$^2$ [2.44 kg/100 m$^2$] approximate weight)<br><br>Mid – Corrugated Ultra Heavy Duty UV Stabilized Polypropylene<br>(24 lb/1,000 ft$^2$ [11.7 kg/100 m$^2$] approximate weight) |
| Thread | UV Stabilized Polypropylene |

**SC250 is Available with the Following Physical Specifications Per Roll [English Units (Metric Units)]**

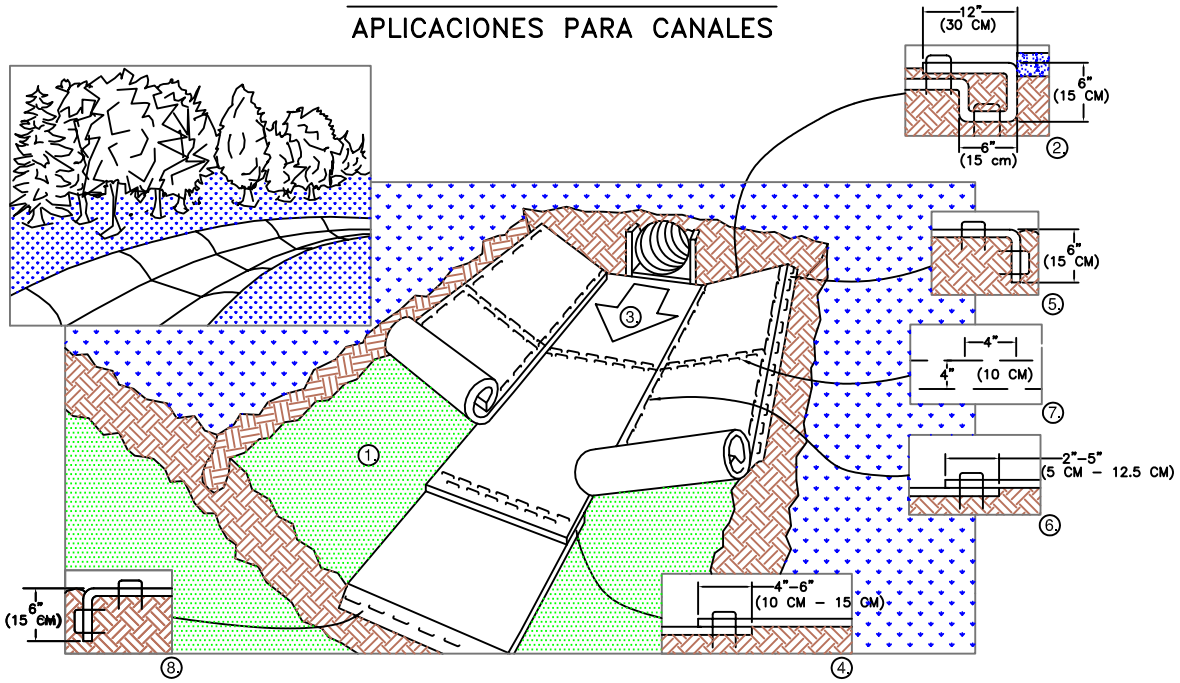
| | |
|---|---|
| **Width** | 6.50 ft (2.00 m) |
| **Length** | 55.50 ft (16.90 m) |
| **Weight ± 10%** | 34.00 lbs (15.42 kg) |
| **Area** | 40.00 yd$^2$ (33.40 m$^2$) |

Stitch Spacing for All Rolls = 1.50 inches (3.81 cm)

NORTH AMERICAN GREEN

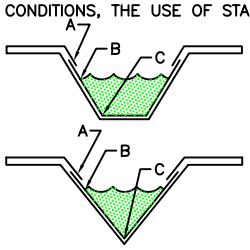
# CHANNEL INSTALLATION

## APLICACIONES PARA CANALES




1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED. NOTE: WHEN USING CELL–O–SEED DO NOT SEED PREPARED AREA. CELL–O–SEED MUST BE INSTALLED WITH PAPER SIDE DOWN.
2. BEGIN AT THE TOP OF THE CHANNEL BY ANCHORING THE BLANKET IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH WITH APPROXIMATELY 12" (30 CM) OF BLANKET EXTENDED BEYOND THE UP–SLOPE PORTION OF THE TRENCH. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMAPCT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" (30 CM) PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" (30 CM) ACROSS THE WIDTH OF THE BLANKET.
3. ROLL CENTER BLANKET IN DIRECTION OF WATER FLOW IN BOTTOM OF CHANNEL. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM™, STAPLES/STAKES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
4. PLACE CONSECUTIVE BLANKETS END OVER END (SHINGLE STYLE) WITH A 4" – 6" (10 CM –15 CM) OVERLAP. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER TO SECURE BLANKETS.
5. FULL LENGTH EDGE OF BLANKETS AT TOP OF SIDE SLOPES MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.
6. ADJACENT BLANKETS MUST BE OVERLAPPED APPROXIMATELY 2" – 5" (5 CM –12.5 CM) (DEPENDING ON BLANKET TYPE) AND STAPLED.
7. IN HIGH FLOW CHANNEL APPLICATIONS, A STAPLE CHECK SLOT IS RECOMMENDED AT 30 TO 40 FOOT (9 M – 12 M) INTERVALS. USE A DOUBLE ROW OF STAPLES STAGGERED 4" (10 CM) APART AND 4" (10 CM) ON CENTER OVER ENTIRE WIDTH OF THE CHANNEL.
8. THE TERMINAL END OF THE BLANKETS MUST BE ANCHORED WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" (30 CM) APART IN A 6" (15 CM) DEEP X 6" (15 CM) WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING.

NOTE:
* IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 CM) MAY BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.




CRITICAL POINTS

A. OVERLAPS AND SEAMS
B. PROJECTED WATER LINE
C. CHANNEL BOTTOM/SIDE SLOPE VERTICES

NOTE:
* HORIZONTAL STAPLE SPACING SHOULD BE ALTERED IF NECESSARY TO ALLOW STAPLES TO SECURE THE CRITICAL POINTS ALONG THE CHANNEL SURFACE.

** IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" (15 cm) MAY BE NECESSARY TO PROPERLY ANCHOR THE BLANKETS.

PUNTOS CRITICOS

A. TRASLAPES Y JUNTAS
B. LINEAS DE AGUA PROYECTADA
C. FONDO DEL CANAL/VERTICES DE LAS PENDIENTES LATERALES

NOTA:
* LA SEPARACION HORIZONTAL DE LAS GRAPAS SE DEBE ALTERAR SI SE NECESITA, PARA PERMITIR QUE LAS GRAPAS ASEGUREN LOS PUNTOS CRITICOS A LO LARGO DE LA SUPERFICIE DEL CANAL.

** EN CONDICIONES DE SUELO SUELTO, PUEDE QUE SE NECESITEN GRAPAS O ESTACAS DE MAS DE 6" (15 CM) DE LARGO PARA ASEGURAR LAS MANTAS CORRECTAMENTE.

---

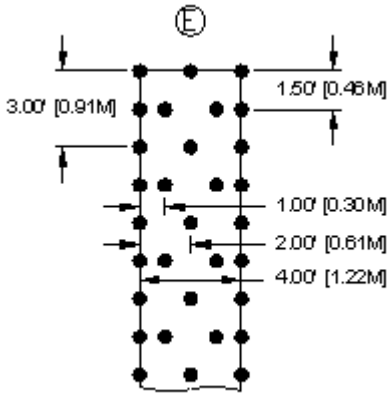
1. PREPARE EL SUELO DE COLOCAR LAS MANTAS, INCLUYENDO LA APLICASION DE CAL, FERTILIZANTE SEMILLA. NOTA: CUANDO ESTE USANDO CELL–O–SEED NO SIEMBRE EL AREA PREPARADA. CELL–O–SEED TIENE QUE INSTALARSE CON EL LADO DE PAPEL HACIA ABAJO.
2. COMIENCE EN LA CABECERA DEL CANAL SUJETANDO LA MANTA EN UNA ZANJA DE 6" (15 CM) DE PROFUNDIDAD POR 6" (15 CM). DE ANCHO CON APROXIMADAMENTE 12" (30 CM) DE LA MANTA EXTENDIDA MAS ALLA DE LA PENDIENTE ALTA DE LA ZANJA. SUJETE RELLENE Y COMPACTE LA ZANJA DESPUES DEL ENGRAPE. RIEGUE LA SEMILLA EN EL SUELO COMPACTADO Y DOBLE LAS 12" (30 CM) REMANENTES DE MANTA SOBRE LA SEMILLA Y EL SUELO COMPACTADO. ASEGURE LA MANTA SOBRE EL SUELO CON UNA LINEADE GRAPAS O ESTACAS APROXIMADAMENTE 12" (30 CM) UNA DE LA OTRA A TRAVES DEL ANCHO DE LA MANTA.
3. DESENROLLE LA MANTA DEL MEDIO EN EL FONDO DEL CANAL Y EN LA DIRECCION DEL FLUJO DE AGUA CON EL LADO APROPIADO HACIA LA SUPERFICIE DEL SUELO. TODAS LAS MANTAS DEBERAN ASEGURARSE A LA SUPERFICIE DEL SUELO POR MEDIO DE GRAPAS O ESTACAS EN LUGARESAPROPIADOS TAL Y COMO SE INDICA EN EL PATRON GUIA DE ENGRAPADO. CUANDO ESTE USANDO EL DOT SYSTEM™. LAS GRAPAS O ESTACAS DEBEN COLOCARSE A TRAVES DE CADA UNO DE LOS PUNTOS CON COLOR CORRESPONDIENTES AL PATRON DE ENGRAPADO APROPIADO.
4. COLOQUE LAS MANTAS CONSECUTIVAS BORDE SOBRE BORDE (TIPO ESCALONADO) CON UN TRASLAPE DE 4" – 6" (10 CM – 15 CM). USE UNA LINEA DOBLE DE GRAPAS ESCALONADAS, SEPARADAS POR 4" (10 CM) Y CADA 4" (10 CM) SOBRE EL CENTRO PARA ASEGURAR LAS MANTAS.
5. EN EL TOPE DE LAS DOS PENDIENTES LATERALES DEL CANAL, SE DEBE SUJETAR TODO EL LARGO DE LA ORILLA DE LAS MANTAS CON UNA LINEA DE GRAPAS O ESTACAS APROXIMADAMENTE CADA 12" (30 CM) UNA DE LA OTRA EN UNA ZANJA DE 6" (15 CM) DE PROFUNDIDAD POR 6" (15 CM) DE ANCHO. RELLENE Y COMPACTE LA ZANJA DESPUES DEL ENGRAPE.
6. LAS MANTAS ADYACENTES DEBEN TRASLAPARSE APROXIMADAMENTE DE 2" – 5" (5 CM– 12.5 CM) (DEPENDIENDO DEL TIPO DE. MANTA) Y ENGRAPPARSE.
7. EN APLICACIONES PARA CANALES DE FLUJO ALTO, SE RECOMIENDA DEJAR UNA RANURA PARA EL CHEQUEO DE LAS GRAPAS A INTERVALOS DE 30 A 40 PIES (9 M – 12 M). USE UNA LINEA DOBLE DE PRAPAS ESCALONADAS, SEPARADAS POR 4" (10 CM) Y CADA 4" (10 CM) SOBRE EL CENTRO A TRAVES DE TODO EL ANCHO DEL CANAL.
8. LOS BORDES FINALES DE LAS MANTAS DEBEN SUJETARSE CON UNA LINEA DE GRAPAS O ESTACAS APROXIMADAMENTE CADA 12" 30 CM) UNA DE LA OTRA EN UNA ZANJA DE 6" (15 CM) DE PROFUNDIDAD POR 6" (15 CM) DE ANCHO. RELLENE Y COMPACTE DESPUES DEL ENGRAPADO.

NOTA:
* EN CONDICIONES DE SUELTO, PUEDE QUE SE NECESITEN GRAPAS O ESTACAS DE MAS DE 6" (15 CM) DE LARGO PARA ASEGURAR LAS MANTAS CORRECTAMENTE.

NORTH AMERICAN GREEN

**Staple Pattern E**
**4 ft (1.2m) wide rolls**

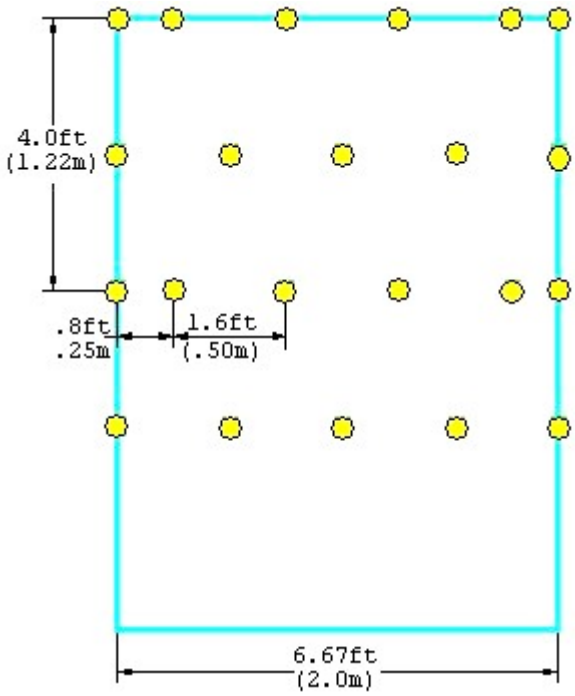
Install using 3.6 staples/yd$^2$ (4.3 staples/m$^2$), 6-in (15.2 cm), 11 ga. wire "U" shaped staples. Longer staples may be required for loose soil conditions. Larger gauge staples may be needed for compacted or rocky soils. Secure RECPs by placing staples/stakes using the noted spacing.



NORTH AMERICAN GREEN

**Staple Pattern E**
**6.67 ft (2.03m) wide rolls**

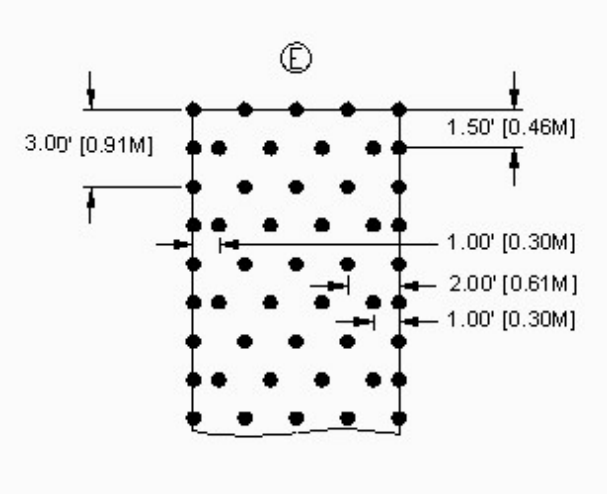
Install using 3.75 staples/yd$^2$ (4.5 staples/m$^2$), 6-in (15.2 cm), 11 ga. wire "U" shaped staples. Longer staples may be required for loose soil conditions. Larger gauge staples may be needed for compacted or rocky soils. Secure RECPs by placing staples/stakes using the noted spacing or placing a staple/stake through each YELLOW colored dot.



NORTH AMERICAN GREEN

**Staple Pattern E**
**8 ft (2.4m) wide rolls**

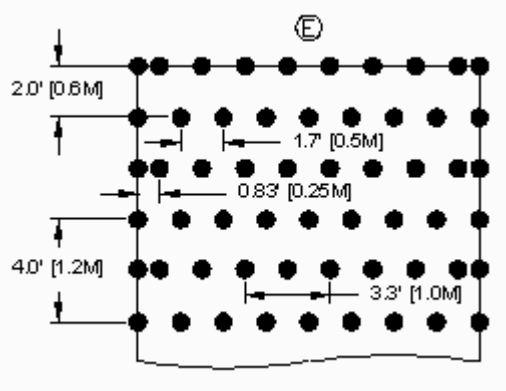
Install using 3.6 staples/yd$^2$ (4.3 staples/m$^2$), 6-in (15.2 cm), 11 ga. wire "U" shaped staples. Longer staples may be required for loose soil conditions. Larger gauge staples may be needed for compacted or rocky soils. Secure RECPs by placing staples/stakes using the noted spacing.



NORTH AMERICAN GREEN

**Staple Pattern E**
**13.3 ft (4.5m) wide rolls**

Install using 3.75 staples/yd$^2$ (4.1 staples/m$^2$), 6-in (15.2 cm), 11 ga. wire "U" shaped staples. Longer staples may be required for loose soil conditions. Larger gauge staples may be needed for compacted or rocky soils. Secure RECPs by placing staples/stakes using the noted spacing.



NORTH AMERICAN GREEN

**Staple Pattern E**
**16 ft (4.8m) wide rolls**

Install using 3.6 staples/yd$^2$ (4.3 staples/m$^2$), 6-in (15.2 cm), 11 ga. wire "U" shaped staples. Longer staples may be required for loose soil conditions. Larger gauge staples may be needed for compacted or rocky soils. Secure RECPs by placing staples/stakes using the noted spacing.