FINAL

City of Tucson
Los Reales Landfill
10-Year General Plan
(2014 to 2024)

City of Tucson, AZ

November 11, 2014

CDM Smith

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Appendices

Tables

Section 1
Landfill Summary

1.1 Introduction

CDM Smith was retained by the City of Tucson (City) to develop a 10-year General Plan for the Los Reales Landfill (Landfill). Planning activities include calculating in-place waste density and soil cover usage, estimating remaining landfill life, estimating development schedules for cell construction projects, and developing a 10-year General Plan for the landfill site.

1.2 Landfill History

The Landfill is located at 5300 E. Los Reales Road which is located in southeastern Tucson. The Landfill consists of approximately 1,087 acres in an area southwest of Interstate 10 between Swan Road and Wilmot Road. The Landfill began as a borrow pit during construction of Interstate 10 in the 1950's. In 1967, the City opened the Landfill. The first lined cell was constructed in July 2000. Cells 2 and 3 which are also lined were constructed in 2002 and 2009, respectively. The City is currently placing waste in Cell 3.

The Landfill is being operated in accordance with the Arizona Department of Environmental Quality (ADEQ) May 27, 2005 Type IV Lateral Expansion and Other Modification Approvals (Approval Number 07019500.03)

1.3 Purpose of Study

The purpose of this study is to develop and analyze waste filling options to optimize available airspace at the Los Reales landfill. The results of the study will be the development of a 10-Year General Plan for the landfill. The report is organized into the following sections:

- Section 1 Landfill Summary
- Section 2 Airspace and Soil Utilization Factors
- Section 3 Remaining Airspace Estimates
- Section 4 10-Year General Plan
- Section 5 Fill Sequencing Plan
- Section 6 Recommendations

Section 2

Airspace and Soil Utilization Factors

2.1 Current and Historic Landfill Tonnages

In 2013, 498,638 tons of municipal solid waste (MSW) was accepted, processed, and disposed at the Landfill. The Landfill has experienced significant reduction in tonnages since 2007 when a total of 825,999 tons were disposed at the Landfill. Reduction in tonnages is attributed to diversion of commercial (private sector) waste to landfills located outside the City of Tucson metropolitan area. **Table 2-1** summarizes historic waste tonnages at the Landfill.

Table 2-1 Los Reales Landfill Historic Waste Tonnages

Year	Total Tons	Commercial	City – Residential	City - Commercial	Self-Haul
2006	701,697	435,552	138,508	87,998	39,639
2007	825,999	550,776	143,489	93,744	37,990
2008	588,532	325,350	141,814	88,590	32,778
2009	407,145	127,015	151,694	98,882	29,554
2010	477,675	208,097	153,555	86,199	29,825
2011	447,258	187,640	150,957	79,689	28,971
2012	479,516	234,536	143,902	73,954	27,124
2013	498,638	265,903	140,755	65,557	26,423

2.2 Projected Waste Tonnages

The City has experienced a slight increase in tonnages since 2011 and is projected to process and dispose approximately 500,000 tons of MSW in 2014. For masterplanning purposes, the project team used 500,000 tons per year as the base tonnage to perform landfill life calculations. A sensitivity analysis was performed to determine the impact(s) of increased densities and tonnages on landfill longevity.

2.3 Airspace and Soil Utilization Factors[1,2]

2.3.1 Total Airspace Depletion

Utilizing AutoCAD Civil 3-D software, total airspace depletion was estimated by comparing April 20, 2012 and May 16, 2014 topographic surveys provided by the City. (**Appendix A, Drawing C-1**)

[1] AutoCADD generated volumes based on national map accuracy standards which require that no more 10% of elevations tested shall be in error more than one-half the contour interval (approximately +/- 6”).

[2] Normal subsidence of existing MSW impact volume calculations.

The following values resulted from this analysis:

- A total of **1,634,898 cubic yards** (cy) of airspace was depleted, including waste and soil cover (daily and intermediate cover). See notes 1& 2.
- The average airspace depletion rate is **65,395 cy** per month (per 25 month period).

2.3.2 Total Soil Usage - AutoCAD

Utilizing AutoCAD Civil 3-D software, total soil usage was estimated by comparing April 20, 2012 and May 16, 2014 topographic surveys provide by the City. (**Appendix A Drawing C-1**) See **Table 2-2** for AutoCAD generated soil cut/fill summary.

Table 2-2 AutoCad Generated Soil Cut/Fill Volumes

Soil Cut/Fill Area	Volume
Cell 4 Borrow Area Cut	74,464 cy
East Borrow Area Cut	419,837 cy
East Borrow Area Fill	21,348 cy
Net – East Borrow Area Cut	398,489 cy
Total Cut (Cell 4 and East)	**472,953 cy**

2.3.3 Total Soil Usage – City Provided Load Counts

Utilizing daily soil load counts provided by the City, total soil usage was estimated for the period from April 20, 2012 and May 16, 2014. The "loose" values were converted to "plan quantity" by using a 25% expansive factor (factor for sand/silty soil ranges from 20 to 30%) and compared to volumes calculated using AutoCAD software in **Subsection 2.3.2**. See **Table 2-3** for City provided soil usage data.

Table 2-3 Soil Usage – Cut/Volumes

Soil Usage Areas	Loose	Plan Quantity [1]	Percent [2]
Cell 4 Borrow - Hauled Offsite for Landfill Closure	**51,053 cy**	**40,824 cy**	
Cell 3 Working Face[3]	285,814 cy	228,651 cy	56.1%
Cell 3 Dress[3]	181,857 cy	145,485 cy	35.7%
Drainage Sand, Roads, Berms,Misc.	42,188 cy	33,750 cy	8.3%
Net – East Borrow Area – Cut	**509,859 cy**	**407,886 cy**	
Total	**560,912 cy**	**448,710 cy**	

1. To check soil volumes, Table 2-2 presented (398,489 cy) whereas Table 2-3 provided load count (407,886 cy) volumes. The volumes are within 2% of each other.
2. Percentage of load counts applied to Cell 3 working face, dress and Cells 1 & 2 drainage sand, misc.
3. Considered daily and intermediate cover

Comparing City provided and AutoCAD generated soil usage data verified that the plan quantity data is accurate (within 2 %). Based on City provided data, approximately 92% of the soil material was used for daily and intermediate cover.

2.3.4 Soil Usage Factor

Utilizing City provided soil load counts (92% as cover and 8% as other) and AutoCAD generated cut volumes, the following values resulted from this analysis:

- Approximately **398,379 cy** of soil was used from the Cell 4 and East Borrow areas to provide daily and intermediate cover material for the Cell 3 working face and Cell 3 dress (deck maintenance); which means that soil represents approximately **24% of the consumed airspace (1,634,898).** Expressed as a cover ratio (waste volume:soil volume), it is **3.10 to 1**.

$$\frac{\{1{,}634{,}060\ cy\ (total) - 398{,}379 cy\ (soil)\}}{\{398{,}379 cy\ (soil)\}} = 3.10$$

Total soil usage was calculated by adding East Borrow Net Cut (398,489) and Cell 4 Cut (74,464) and subtracting soil hauled offsite (40,824) and other soil used (33,750).

2.4 MSW Effective Density

The effective density of MSW disposed between April 20, 2012 and May 16, 2014 was calculated by dividing the tons of waste landfilled (**1,022,400 tons**), based on waste receipts, by the airspace consumed (**1,634,898 cy**). The calculated effective density is **1,250 pounds per cubic yard (lb/cy).** The effective density accounts for waste landfilled and the soil cover used.

2.5 Airspace Utilization Factor

The Airspace Utilization Factor (AUF) was calculated to determine airspace utilization the period between April 20, 2012 and May 16, 2014. AUF is the ratio of airspace consumed between topographic surveys and the tons of waste landfilled between the topographic survey dates. The calculated AUF for the Los Reales Landfill is **0.625 tons per cubic yard (tons/cy)** for this period.

Section 3
Remaining Airspace Estimates

3.1 Interim Grading Plans

To estimate remaining airspace, the landfill was divided into distinct areas (See **Appendix A Drawing C-2 Overall Site Plan**) as described below:

- Area A – Cells 1, 2, 3 and Top Deck
- Area B – Future Cell 4
- Area C – Future West Development
- Area D – Future South Development

At the project kick-off meeting/project workshop, it was decided to maximize available airspace by developing interim grading plans for Areas A and Cell 3. Interim grading plans were developed using final permit grades and interim sideslope grades. For sideslopes not expected to receive MSW for an extended period of time, 4 horizontal to 1 vertical temporary grades were used. For areas adjacent to the future Area B (Cell 4) lined area, 3 horizontal to 1 vertical sideslopes were used.

3.2 Remaining Airspace – Interim Grading Plans

3.2.1 Area A - Airspace Estimate

To estimate available airspace remaining for Area A, AutoCAD Civil 3-D software was used to estimate volume remaining between the January 16, 2014 topographic survey and the Area A interim grading plan. See **Appendix A – Drawings C-3 thru C-5** for Area A interim grading plan, cross sections, and depth of fill maps.

Available airspace volumes were calculated using the new interim grading plans and January 2014 topographic mapping resulting in the following volume:

- Area A Remaining Net Airspace: 8,043,624 cy

The results indicate that current available airspace will provide approximately 8.4 to 12.1 years of airspace, depending on in-place MSW density and tonnage rates. **Table 3-1** summarizes the results of the analysis for Area A and **Table 3-2** summarizes for the Cell 3 Area. A summary spreadsheet of various waste filling and waste density scenarios is shown in **Appendix B.**

Appendix A – Drawing C-6 represents a color coded map showing depth of fill in Area.

Table 3-1 Area A Estimated Remaining Life Summary
Estimated Net Airspace = 8,043,624 cy[1]

Scenario	In-Place Density (lb/cy)	Tonnage per Year (tons)	Volume per Month (cy/month)	Est Life (years)	Est. End Date
A	1,250	500,000	66,667	10.1	Feb. 2024
B	1,500	500,000	55,556	12.1	Feb. 2026
C	1,250	600,000	80,000	8.4	June 2022

1. Net airspace is total airspace minus final cover

3.2.2 Cell 3 - Airspace Estimate

To estimate available airspace remaining for Cell 3, AutoCAD Civil 3-D software was used to estimate the volume remaining between the January 16, 2014 topographic survey and the Cell 3 interim grading plan. See **Appendix A – Drawings C-7 and C-8** for Cell 3 Interim Grading Plan and Cross Sections.

Available airspace volumes were calculated using the new interim grading plans and January 2014 topographic mapping resulting in the following volume:

- Cell 3 Remaining Net Airspace: 3,057,200 cy

The results indicate that available airspace in the Cell 3 area will provide approximately 3.2 to 4.6 years of airspace, depending on in-place MSW density and tonnage rates. **Table 3-2** summarizes for the Cell 3 Area. **Appendix B** includes the calculations.

Table 3-2 Cell 3 Remaining Life Summary
Estimated Net Airspace = 3,057,200 cy[1]

Scenario	In-Place Density (lb/cy)	Tonnage per Year (tons)	Volume per Month (cy/month)	Est Life (years)	Est. End Date
A	1,250	500,000	66,667	3.8	Oct. 2017
B	1,500	500,000	55,556	4.6	July 2018
C	1,250	600,000	80,000	3.2	March 2017

1. Net airspace is total airspace minus final cover

Section 4
10-Year General Plan

This 10-Year General Plan provides the City direction and guidance on planning/managing proposed projects at the Los Reales Landfill. Identifying capital projects assists the City in planning and scheduling of finances and identifies manpower/equipment needs to plan, design, and construct projects. The project team developed a list of projects to be performed at the landfill over the 10 year planning period that are summarized in the following sections.

4.1 Area B (Cell 4) Development

4.1.1 Contractor Performed Work

Based on current disposal rates and operating practices, the existing landfill has approximately 8 to 12 years of airspace remaining before Area B (Cell 4) is needed. The City should begin procurement and selection of an engineering consultant to perform cell design, bidding and construction quality assurance (CQA) services no later than 2020/2021. The engagement date is subject to disposal tonnages and airspace utilization factors and should be evaluated annually to further refine the proposed development schedule. The 10-Year General Plan Schedule is located in **Appendix C** and the 10- Year Cash Flow estimate is in **Appendix D**. Estimated Cell 4 Development costs are $250k for engineering, $250k for services during construction (CQA certification), and $4.5 to $5.0 million (2014 dollars) to complete construction of the approximately 30 acre Cell 4 liner and leachate collection system.

4.1.2 City Performed Work

The City should continue to use Area B (Cell 4) and the East Borrow area as sources for daily and intermediate cover. The City should continue to utilize this borrow source and excavate to 12" above liner grades. The City should utilize Cell 4 borrow area for daily/intermediate cover and then move to the East Borrow area.

4.2 Partial Landfill Closure

4.2.1 City Performed Work

Once Cell 3 final grades are reached in approximately 2017, the City should consider performing final closure of select areas (sideslopes) by preparing detailed design drawings for closure of Cells 1, 2, and 3 sideslopes. After approval of the detailed closure drawings, the City should commence placement of the final capping materials. It is estimated that up to 80 to 100 acres of sideslope areas will be ready for partial closure requiring the excavation and placement of 200,000 cy of soil material.

4.2.2 Contractor Performed Work

Contractor performed work will be limited to installation of stormwater structures, erosion control structures, and completing seeding of partially closed areas. The City should budget $175k per year to perform this work.

4.3 Miscellaneous Landfill Improvement Projects

4.3.1 Contractor Performed Work

A number of projects will need to be completed on a routine basis to reduce soil erosion, minimize blowing debris, and to maintain LFG collection and control system operations. The City should utilize on-call contractors to repair and/or extend LFG collection system components, provide seeding of partially closed sideslopes, construct stormwater structures including gabion down drains and stormwater piping, and to install litter control fencing. The estimated cost for this work is approximately $175,000 per year.

Section 5
Fill Sequencing Plan

5.1 Waste Fill Sequencing

A proposed waste filling plan is included in **Appendix A – Drawing C-9**. The plan is based on available airspace, final permit grading plan, interim grading plan for Area A, available waste depths, borrow source locations, and access roads. The City should continue to place waste in the Cell 3 area and should "tie into" the existing Cell 2 grades. Once Cell 2 grades are achieved, waste lifts should be placed in cell 2 and 3 together until final elevations are reached. The City should then proceed to the "center", "west", and then complete filling in the "access road" area.

5.2 Soil Excavation Plan

The Los Reales Landfill currently utilizes the future Area B (Cell 4) area as well as the East Borrow area located approximately 2,000 feet east of Cells 1-3 for daily, intermediate, drainage sand, and other miscellaneous soil uses at the site. The east borrow area should also be used as a source for final cover material. Other potential on-site borrow areas include future landfill development to the south and west of the current landfill area.

5.2.1 Daily Soil Usage

Minimizing daily soil usage at the site has a significant impact on operations. Efficient use of soil reduces the amount of airspace consumed, increases airspace utilization factors, decreases excavation and hauling cost, and decreases labor and equipment cost.

Table 5-1 illustrates the impact of soil usage rates has on landfill operations.

Table 5-1 Soil Usage Scenarios

Scenario	Filling Rate (tons per year)	AUF[1]	Total Airspace (cy)	Annual Soil Usage (%)	Annual Soil Usage (CY)	10-Year Soil Usage (cy)
1	500,000	0.625	800,000	26	208,000	2,080,000
2	500,000	0.625	800,000	15	120,000	1,200,000

1. AUF – Airspace Utilization Factor

The City should continue deployment of the tarping system and continue to excavate and haul soil material from the Area B (Cell4) and East Borrow sources.

5.2.2 Final Cover

The interim grading plan identifies significant areas of the landfill that could be closed in the next 10 year period. **Appendix D – Sheet C-9** illustrates the permitted final grading plan for the site.

Specifically, approximately 100 acres of the north slopes of Cell 3 and Cells 1, 2, and 3 east sideslopes could be ready for final cover material. This will require the excavation, hauling, placement, and compaction of up to 500,000 cy of material. To minimize haul distance, the East Borrow Source should be used for final cover placement for Cells 1, 2, and 3 sideslopes.

5.3 Litter Control Plan

5.3.1 Introduction

A successful Los Reales Landfill litter control program requires implementing a number of temporary and permanent programs. This multi-pronged approach includes the installation of permanent litter fencing at the property boundary, movement of portable fencing on a daily basis, installation of temporary fencing downwind of prevailing wind directions, and utilizing permanent or temporary labor forces to patrol fences to minimize excessive litter buildup. With proper implementation, this layered approach will result in redundancy, limiting the quantity of windblown litter that migrates towards the perimeter of the landfill and potentially offsite. Litter fencing is most effective when wind is allowed to flow freely through the mesh, screen or wire. Once the fence becomes plugged with litter, debris or foreign material, wind containing litter is redirected around, over or through openings in the fence.

5.3.2 Portable Litter Fencing

Portable litter fencing has the ability to capture windblown litter at the source of generation. Capturing litter at the source limits the potential for litter contamination spreading throughout the site. When positioning portable fencing at a new fill location, thought should be given as to where customer and equipment access is allowed in relation to the fence location and wind direction. When possible, openings or breaks in the fence line should be avoided, traffic should be routed around the fence lines if the topographic conditions will allow.

Example of Portable Litter Fencing

The individual portable fence sections should be tightly and uniformly configured and free of gaps. If gaps are present, litter will eventually be carried through these openings negating the effectiveness of the fence. As a general rule, fencing should be placed in a semicircular continuous pattern downwind of the prevailing wind direction for the given timeframe. Fencing should be positioned as close to the source of generation as possible without impeding equipment operations or customer access to tipping areas.

5.3.3 Temporary Litter Fencing

Temporary litter fencing is an effective intermediate measure in capturing windblown litter beyond the active landfill tipping area and portable litter fencing zone. Typically, this fencing is constructed using metal t-posts spaced approximately every 6-10 feet. Welded or woven wire fencing, 4-6 feet in height, is the preferred material for this type of fencing. Other materials such as heavy chicken wire, woven textiles and plastic fencing can also be used, but can be difficult to reuse. Vertical and horizontal litter traps can be incorporated into the fence design. These litter traps are effective at retaining litter, minimizing its movement once it has been captured in the fence. Vertical litter traps should be installed at the end of temporary fence lines.

Example of a Horizontal Litter Trap Installed on a Temporary Litter Fence

Temporary fencing should be erected to surround approximately 1-3 months of landfill airspace and should coincide with the landfills fill sequence planning. This method will require the least amount of labor effort to dismantle and reconstruct lines of fencing. Additional temporary fencing can be used for known problem areas, topographic challenges and for areas that portable fencing is not practical. A series of temporary fencing can also be used to capture fine residual litter over a large horizontal surface such as the top surface of the landfill.

5.3.4 Permanent Litter Control Fencing

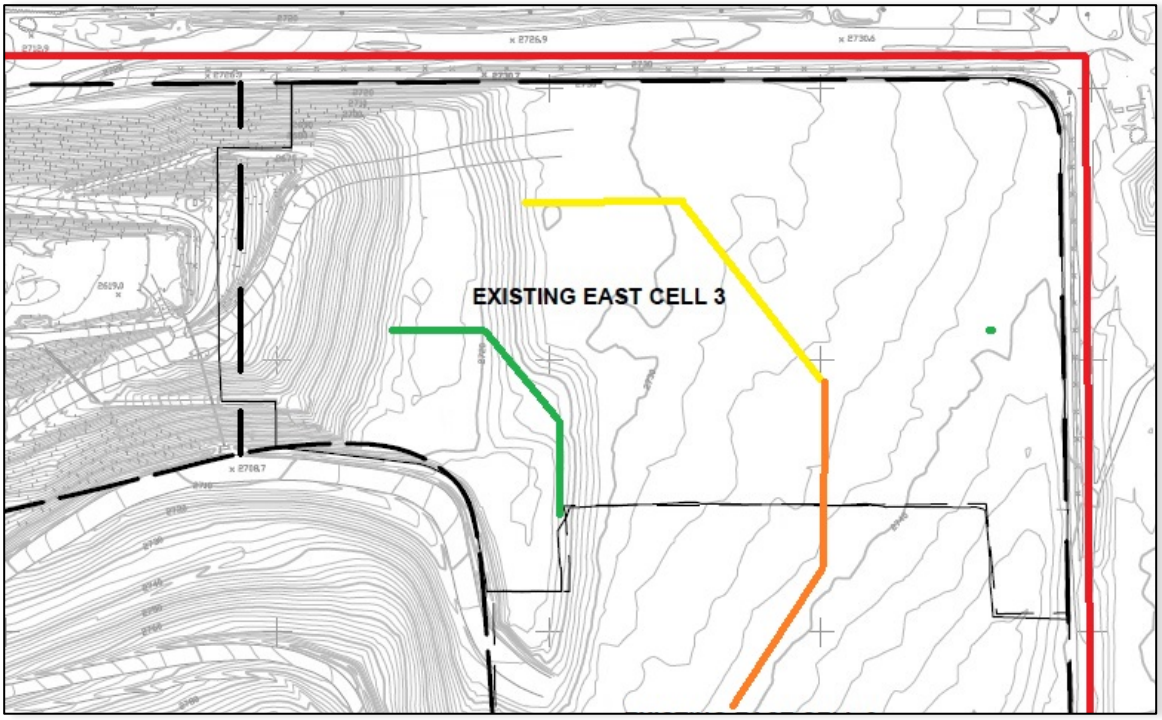
No matter how diligent landfill staff remains in regard to internal fence deployment and maintenance, some litter will make its way to the perimeter of the landfill. With this fact in mind and based on experiences at other facilities we recommend that permanent perimeter litter fencing be utilized to capture residual litter. Many factors must be considered regarding the installation of a permanent perimeter litter fence. Perimeter fencing should be accessible by landfill staff. This will allow labor and maintenance crews to repair fencing as needed and to remove blown litter, debris and foreign material on a regular and possibly daily basis. Thought should be given towards removing litter that has become trapped or stuck within the fencing material. The taller the fence the more this becomes a concern. A hand held pole and hook arrangement can be used for fences in the 12-15 feet range. Fencing taller than 12-15 feet may require more complex processes for removing trapped and stuck litter, in some cases man lifts are required to do so. Periodic vertical litter traps should be installed adjacent to perimeter fencing to minimize litter migration.

Example of a Permanent Perimeter Litter Fence

5.3.5 Typical Litter Control Strategy

The map below shows a typical strategy to implement to minimize blowing debris during prevailing wind situations. The prevailing wind direction at the site is from southwest to northeast (red arrow). In the prevailing wind scenario, we recommend taking an aggressive approach by moving the portable fence (green) downwind and closer to the active tipping area. Temporary litter fencing (yellow) should be deployed to capture residual litter that has potential to migrate beyond the portable fencing. An optional series of temporary fencing could be installed (orange) dependent on wind conditions. We suggest that the placement and movement of temporary fences be flexible to adjust for waste fill sequencing and changing weather conditions.

We suggest that a permanent fence (red) be located around Cell 3 and 4 areas. Final placement of the permanent litter fence should not impede traffic and heavy equipment operations and should facilitate efficient removal of debris caught by the fencing.



Section 6
Recommendations

6.1 Operational Changes to Optimize Landfill Airspace

The 10-Year General Plan identifies the preferred filling approach for the next 10 year period. The approach optimizes available airspace and defers large capital expenses associated with landfill expansions (liner and leachate collection system) construction. However, it is important to note that our work and the resulting construction timeline are based on the landfill's historical performance in regard to airspace consumption and cover soil use.

The quantity of daily and intermediate soil used between the April 20, 2012 and May 16, 2014 topographic surveys was approximately 398,379 cubic yards or 24% of the consumed airspace.

Based on the estimated soil quantities– and those provided by the City – we estimate the historic cover ratio (waste volume ÷ soil volume) is approximately 3.10 to 1.

Based on experience with other similar landfills (and after a closer review of historical soil use), we estimate that Los Reales could achieve a cover ratio as lean as 8 to 1.

By making this type of operational improvement, the landfill could decrease soil consumption by an estimated 54%. This would similarly reduce soil handling costs by 54%, saving approximately $179,434 per year. This is based on reducing soil usage by 89,717 cy per year x $2 per cubic yard cost to excavate, transport and place.

Additionally, by reducing cover soil usage to 8 to 1 (from its current rate of approximately 3.10 to 1) would save approximately 89,717 cubic yards of landfill airspace per year (soil savings), which would be worth approximately $897,000 based on a landfill airspace development cost of $10 per cy.

By using less soil, the proposed Area B (Cell 4) liner construction could be deferred at least one additional year, saving the City over $240,000. This is assuming a "cost of money" interest rate of 5% and a liner construction cost of $4,832,217.

It should be noted that this revenue-based evaluation of airspace does not include any adjustment for time value of money.

We recommend that the City develop plans to reduce daily and intermediate soil usage at the site.

6.2 Partial Closure

To minimize erosion and maintain the highest level of environmental integrity, it is recommended that Los Reales Landfill staff consider placement of final cover in stages as individual areas are brought to final grade. This would include the North Cell 3 side-slopes and the East Cell 1 and 2 side-slopes. This work can be performed by City operations staff thereby eliminating the cost of hiring a contractor. By reducing the effort in excavating, hauling and placing daily cover soil, resources could be used to place final cover material.

6.3 Optimize Cell Geometry

Thousands of daily cells will be constructed over the remaining life of the landfill. In order to improve the operation, we recommend that the process of daily cell construction be evaluated.

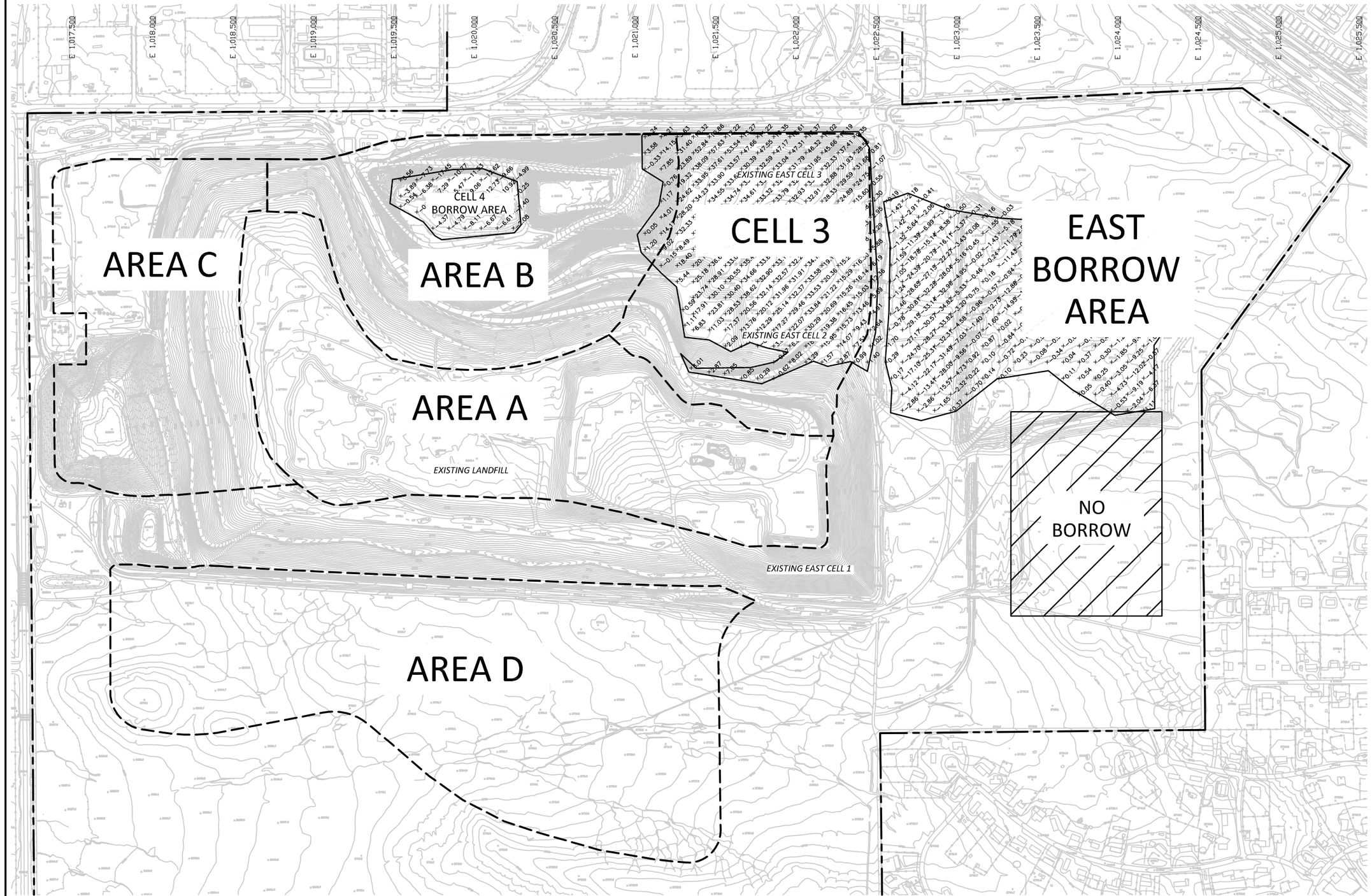
The most efficient cell geometry allows plenty of room for the compactor to work, while minimizing the quantity of soil required.

6.4 Routine Airspace Depletion Calculations

The City should complete aerial topographic mapping of the waste filling and borrow areas at least once per year (or sooner). Airspace depletion and estimated longevity calculations should be performed on a routine basis and cell development schedules should be adjusted accordingly. In addition, we recommend that quarterly ground-based surveys and airspace depletion calculations be performed in areas receiving waste material.

Appendix A

Drawings



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DESIGNED BY: TP
DRAWN BY: ECD
SHEET CHK'D BY: TP
CROSS CHK'D BY: TP
APPROVED BY: X
DATE: JULY 2014

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CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

CUT/FILL ELEVATIONS
2012 SURVEY VS.JUNE 2014 SURVEY

PROJECT NO. 1362-102263
FILE NAME: SURVEY_COMP-CUTFILL

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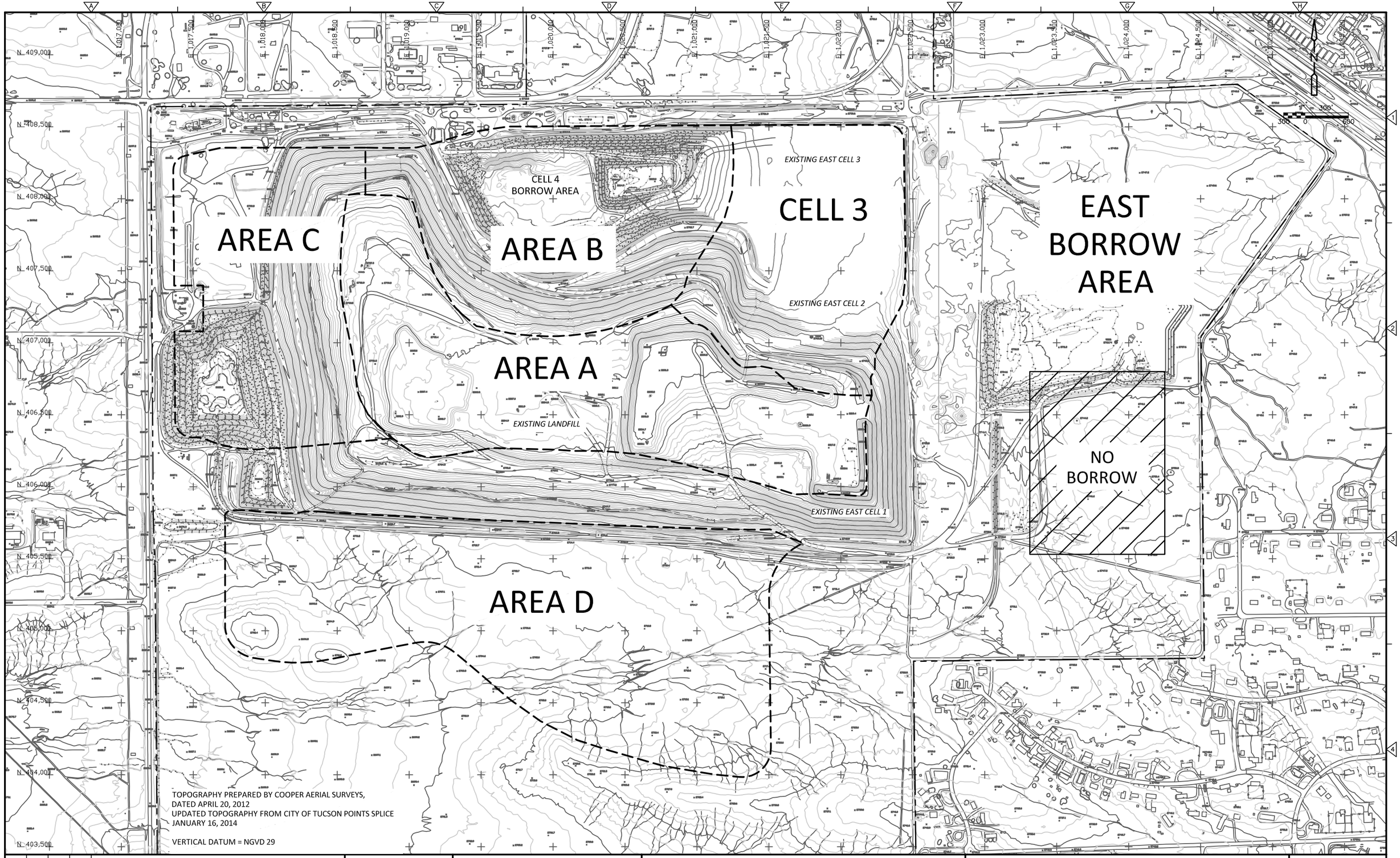

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CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

OVERALL SITE PLAN
DRAFT

PROJECT NO. 1362-102263
FILE NAME: C002GNPLJR.DWG

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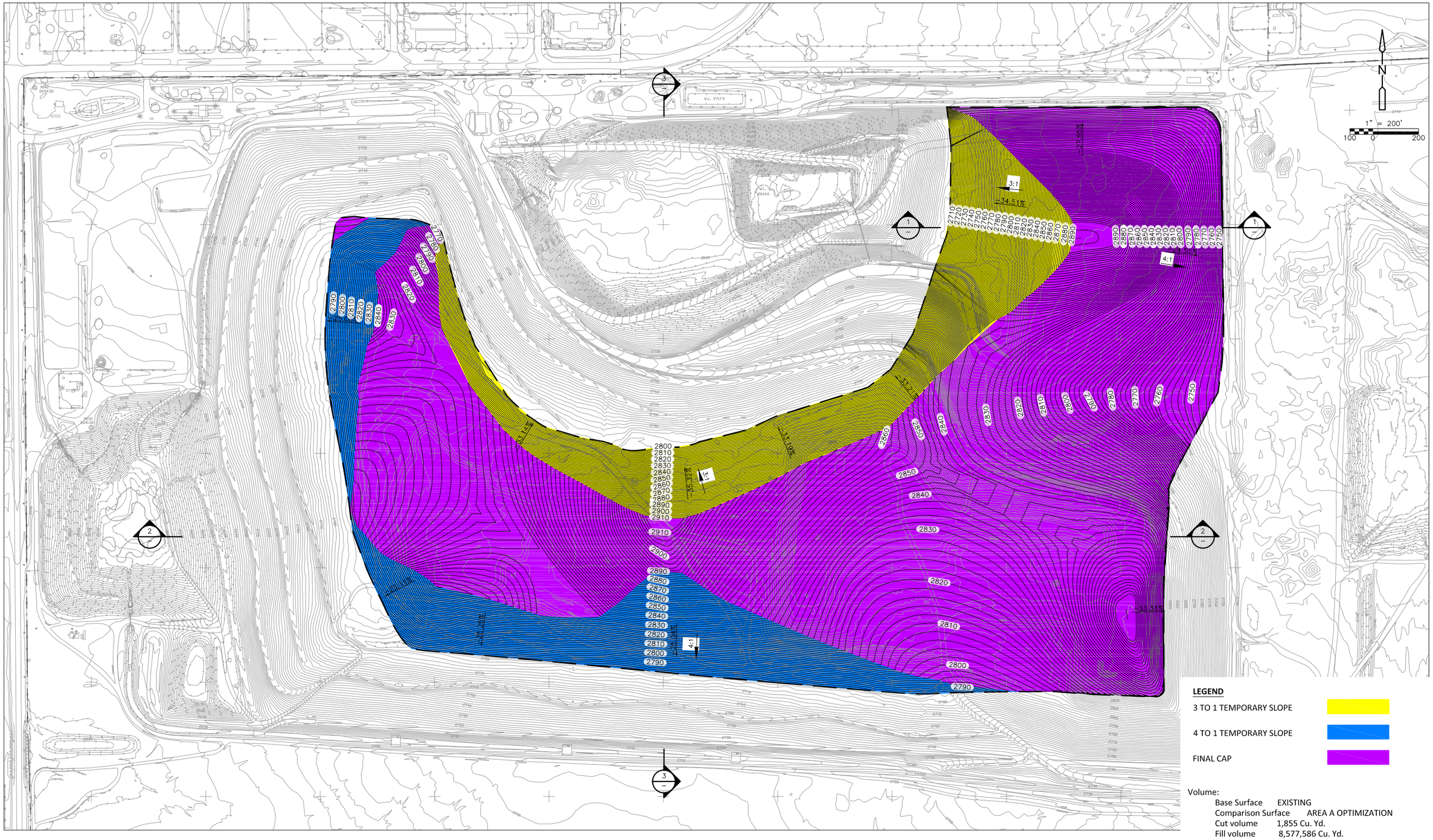

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DATE: JULY 2014

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CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

INTERIM GRADING PLAN
DRAFT

PROJECT NO. 1362-102263
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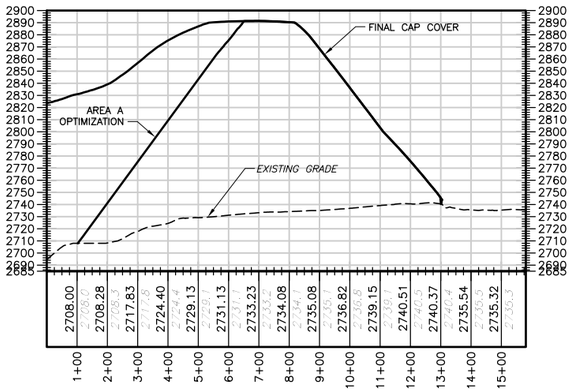
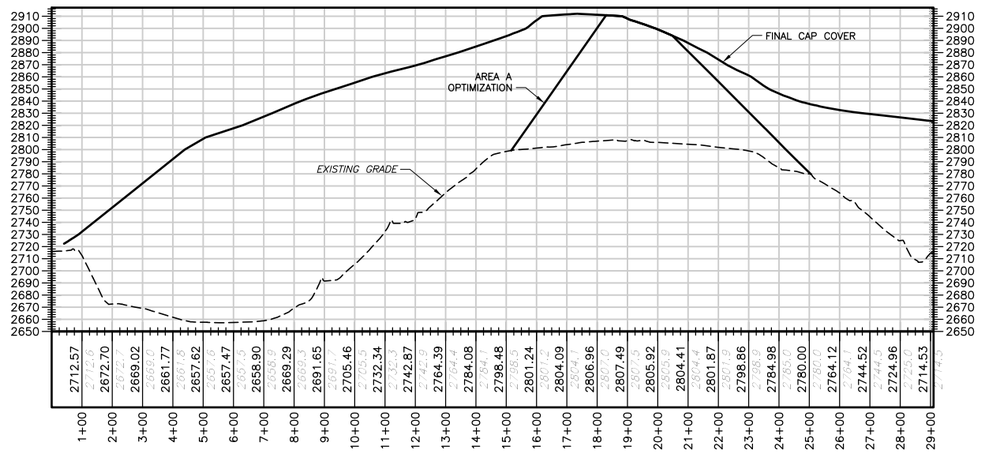


SECTION 1
1" = 250' HOR
1" = 60' VERT



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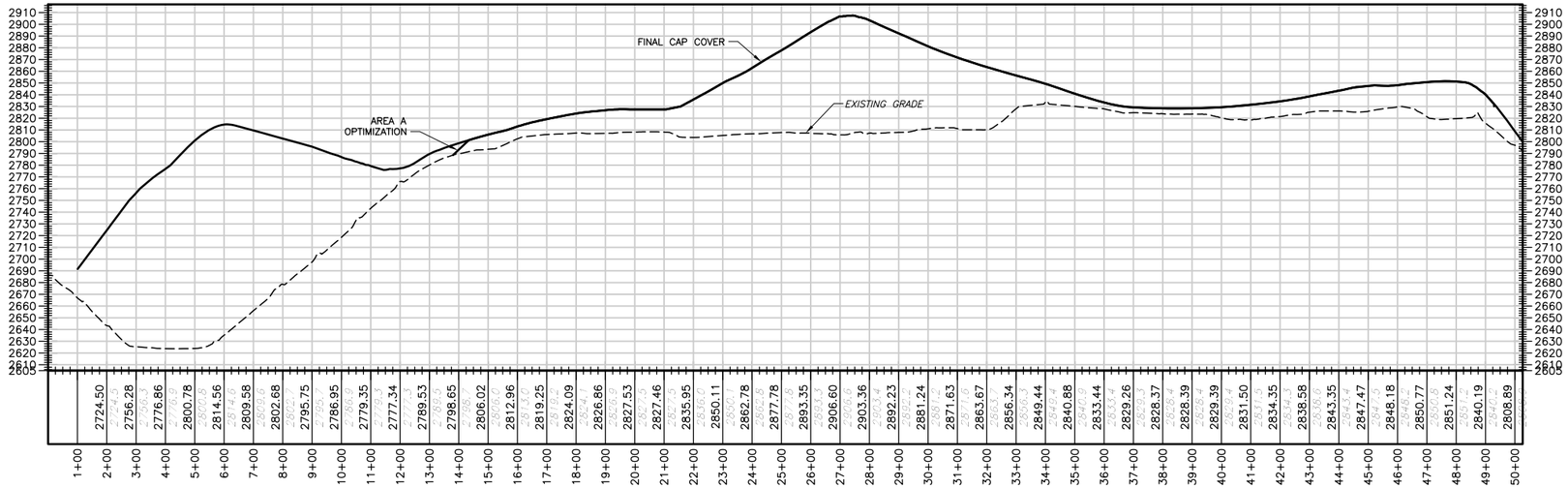

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1" = 250' HOR
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CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

AREA A - CROSS SECTIONS
DRAFT

PROJECT NO. 1362-102263
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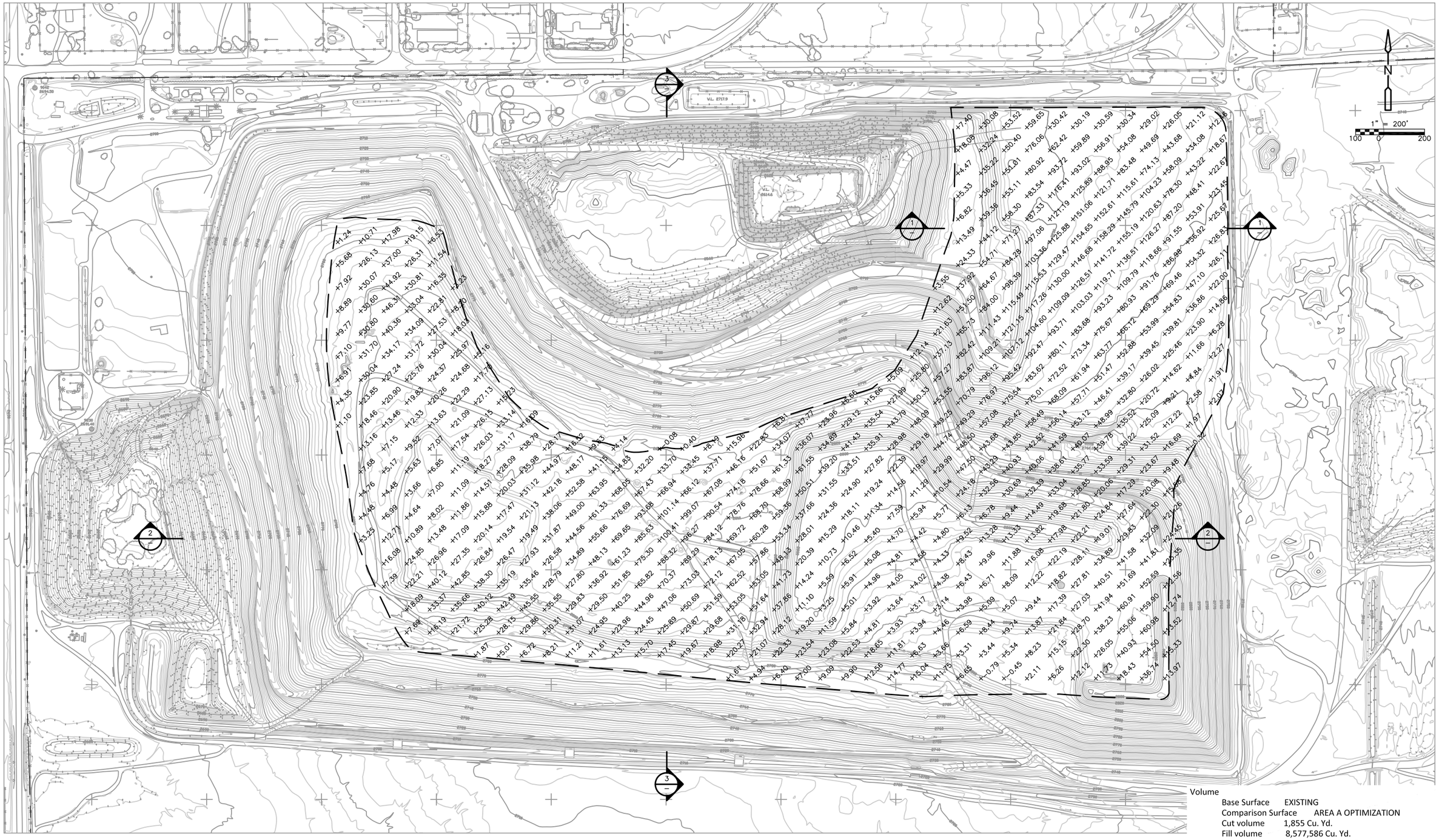
SHEET NO.
C-4



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: TP
DRAWN BY: ECD
SHEET CHK'D BY: TP
CROSS CHK'D BY: TP
APPROVED BY: X
DATE: JULY 2014

CDM Smith
6000 Uptown Blvd N.E., Suite 200
Albuquerque, NM 87110
Tel: (505) 243-3200

CITY OF TUCSON

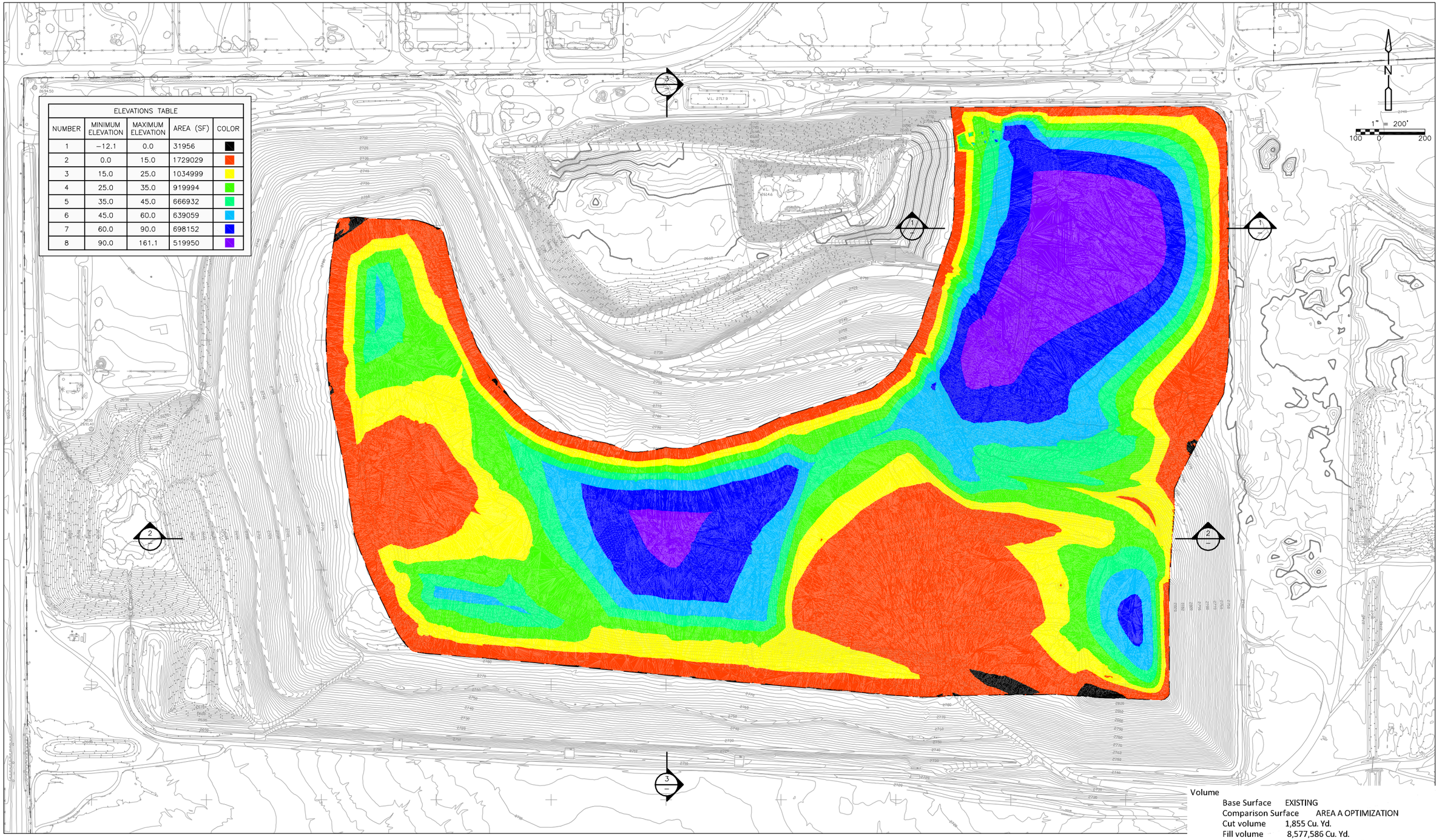
LOS REALES LANDFILL
MASTERPLAN

AREA A DEPTH OF FILL
DRAFT

PROJECT NO. 1362-102263
FILE NAME: C005INTPLJR.DWG

SHEET NO.
C-5

ELEVATIONS TABLE				
NUMBER	MINIMUM ELEVATION	MAXIMUM ELEVATION	AREA (SF)	COLOR
1	−12.1	0.0	31956	
2	0.0	15.0	1729029	
3	15.0	25.0	1034999	
4	25.0	35.0	919994	
5	35.0	45.0	666932	
6	45.0	60.0	639059	
7	60.0	90.0	698152	
8	90.0	161.1	519950	



Volume

Base Surface EXISTING
Comparison Surface AREA A OPTIMIZATION
Cut volume 1,855 Cu. Yd.
Fill volume 8,577,586 Cu. Yd.
Net volume 8,575,731 Cu. Yd.<Fill>

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: TP
DRAWN BY: ECD
SHEET CHK'D BY: TP
CROSS CHK'D BY: TP
APPROVED BY: X
DATE: JULY 2014

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Albuquerque, NM 87110
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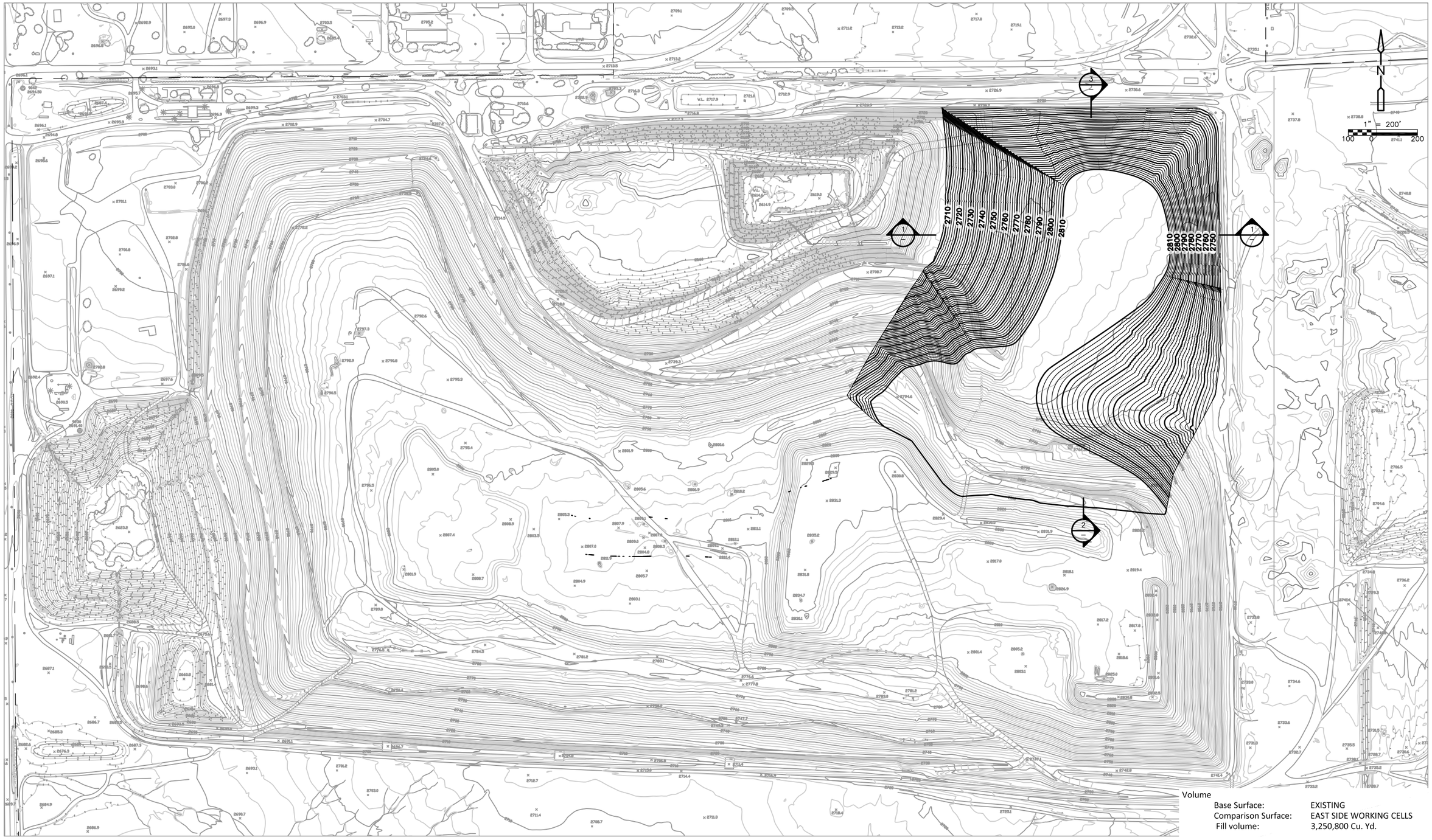
CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

AREA A DEPTH OF FILL COLOR MAP
DRAFT

PROJECT NO. 1362-102263
FILE NAME: C06AINTPLJR.DWG

SHEET NO.
C-6



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: TP
DRAWN BY: ECD
SHEET CHK'D BY: TP
CROSS CHK'D BY: TP
APPROVED BY: X
DATE: JULY 2014

CDM Smith
6000 Uptown Blvd N.E., Suite 200
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Tel: (505) 243-3200

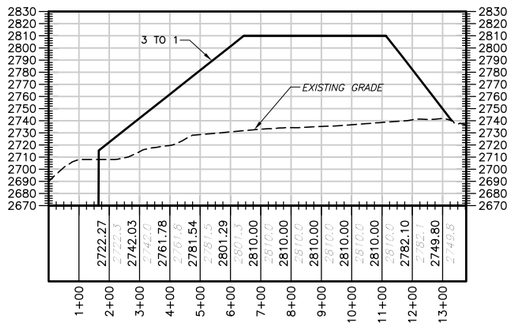
CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

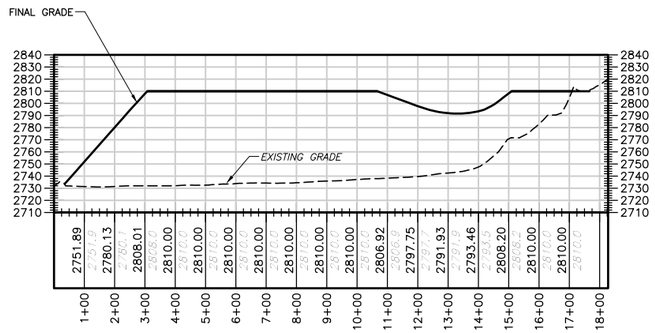
CELL 3 - INTERIM GRADING PLAN
DRAFT

PROJECT NO. 1362-102263
FILE NAME: C007STPLJR.DWG

SHEET NO.
C-7



SECTION 1
1" = 250' HOR
1" = 60' VERT



SECTION 2
1" = 250' HOR
1" = 60' VERT

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: TP
DRAWN BY: ECD
SHEET CHK'D BY: TP
CROSS CHK'D BY: TP
APPROVED BY: X
DATE: JULY 2014

CDM Smith
6000 Uptown Blvd N.E., Suite 200
Albuquerque, NM 87110
Tel: (505) 243-3200

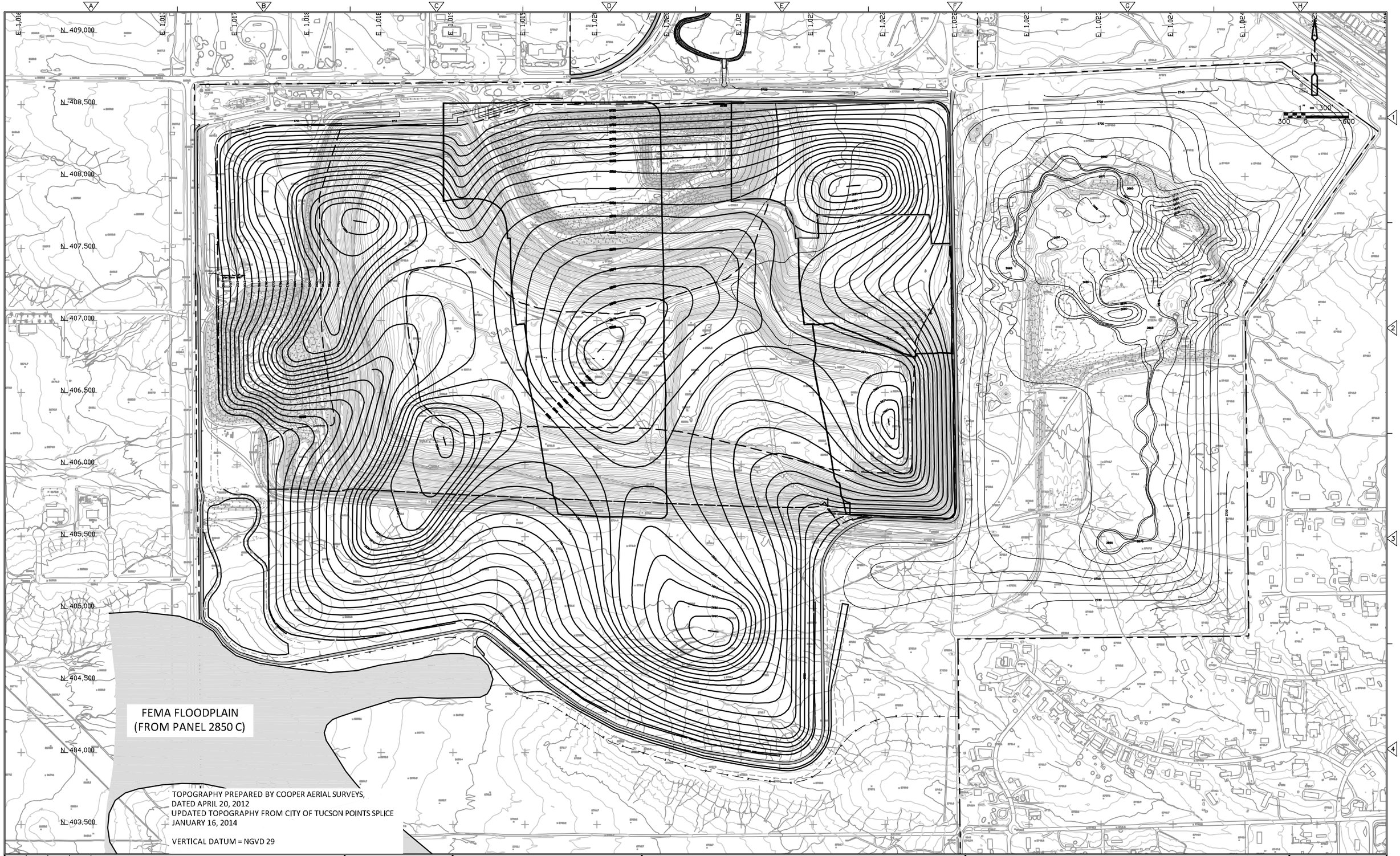
CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

CELL 3 - CROSS SECTIONS
DRAFT

PROJECT NO. 1362-102263
FILE NAME: C008STSCJR.DWG

SHEET NO.
C-8



TOPOGRAPHY PREPARED BY COOPER AERIAL SURVEYS,
DATED APRIL 20, 2012
UPDATED TOPOGRAPHY FROM CITY OF TUCSON POINTS SPLICE
JANUARY 16, 2014

VERTICAL DATUM = NGVD 29

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: TP
DRAWN BY: ECD
SHEET CHK'D BY: TP
CROSS CHK'D BY: TP
APPROVED BY: X
DATE: JULY 2014

CDM Smith
8000 Uptown Blvd NE., Suite 200
Albuquerque, NM 87110
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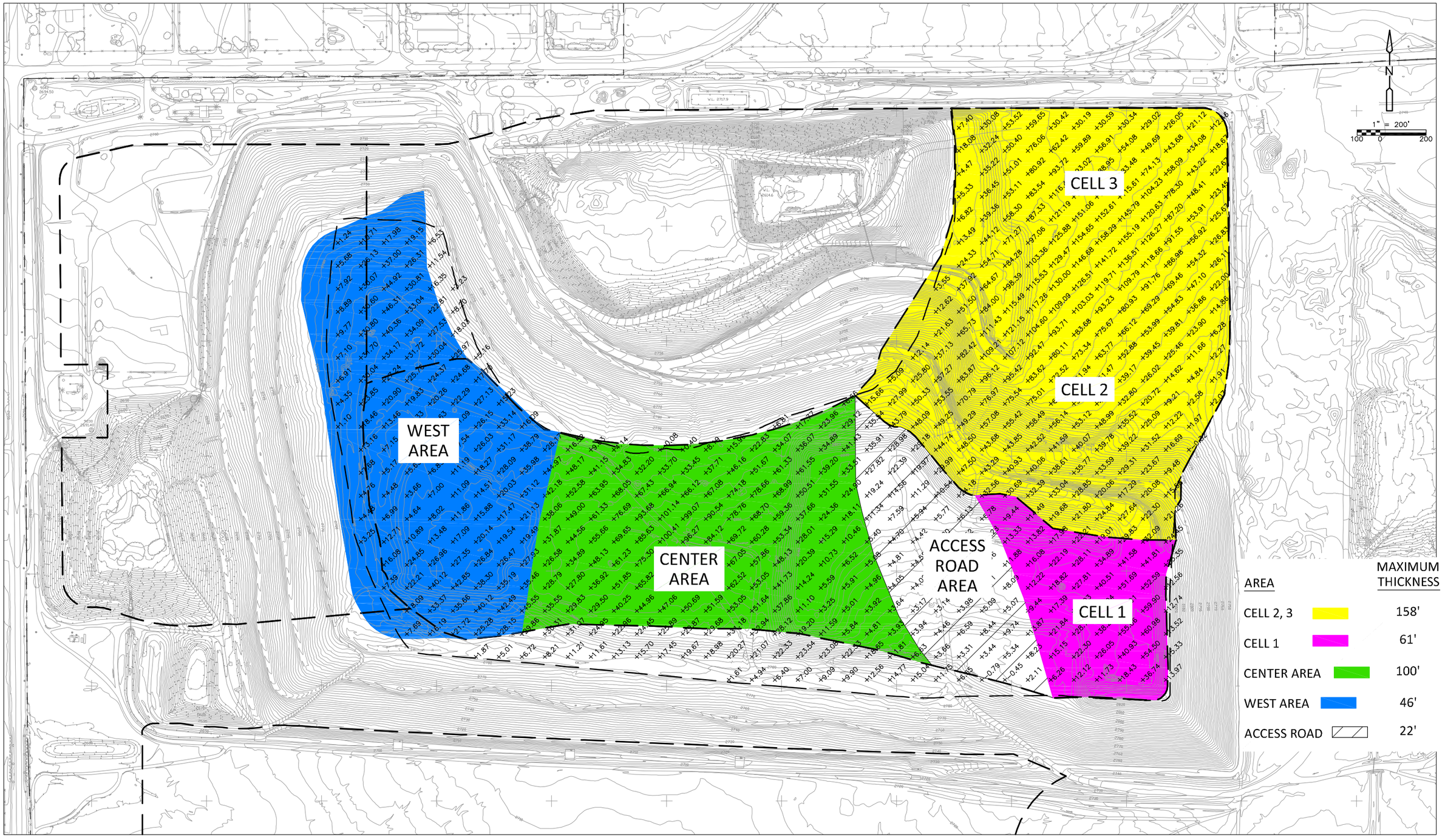
CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

FINAL COVER PLAN
DRAFT

PROJECT NO. 1362-102263
FILE NAME: C009GRPLJR.DWG

SHEET NO.
C-9



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: TP
DRAWN BY: ECD
SHEET CHK'D BY: TP
CROSS CHK'D BY: TP
APPROVED BY: X
DATE: JULY 2014

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6000 Uptown Blvd NE, Suite 200
Albuquerque, NM 87110
Tel: (505) 243-3200

CITY OF TUCSON

LOS REALES LANDFILL
MASTERPLAN

FILL SEQUENCING PLAN
DRAFT

PROJECT NO. 1362-102263
FILE NAME: C010INTPLJR.DWG
SHEET NO.
C-10

Appendix B

Airspace Evaluation Summary

Appendix B
City of Tucson
Los Reales Landfill Masterplanning
Airspace Evaluation Summary

Scenerio A 1,250 lb/cy - 500,000 TPY January 16, 2014 Topographic Map										
Option	Gross Volume	Allowance for Final Cover	Net Volume	Tonnage per Year	Tonnage per Month	Volume per Month	Estimated Lifespan	Estimated Lifespan	Estimated End Date	Estimated Daily/Int. Cover
	CY	CY	CY	Tons	Tons	CY	Mo.	Years	Date	CY
Area A	8,577,600	533,976	8,043,624	500,000	41,667	66,667	120.7	10.1	February-24	2,091,342
Cell 3 Only	3,250,800	193,600	3,057,200	500,000	41,667	66,667	45.9	3.8	October-17	794,872

Scenerio B 1,500 lb/cy - 500,000 TPY January 16, 2014 Topographic Map										
Option	Gross Volume	Allowance for Final Cover	Net Volume	Tonnage per Year	Tonnage per Month	Volume per Month	Estimated Lifespan	Estimated Lifespan	Estimated End Date	Estimated Daily/Int. Cover
	CY	CY	CY	Tons	Tons	CY	Mo.	Years	Date	CY
Area A	8,577,600	533,976	8,043,624	500,000	41,667	55,556	144.8	12.1	February-26	2,091,342
Cell 3 Only	3,250,800	193,600	3,057,200	500,000	41,667	55,556	55.0	4.6	July-18	794,872

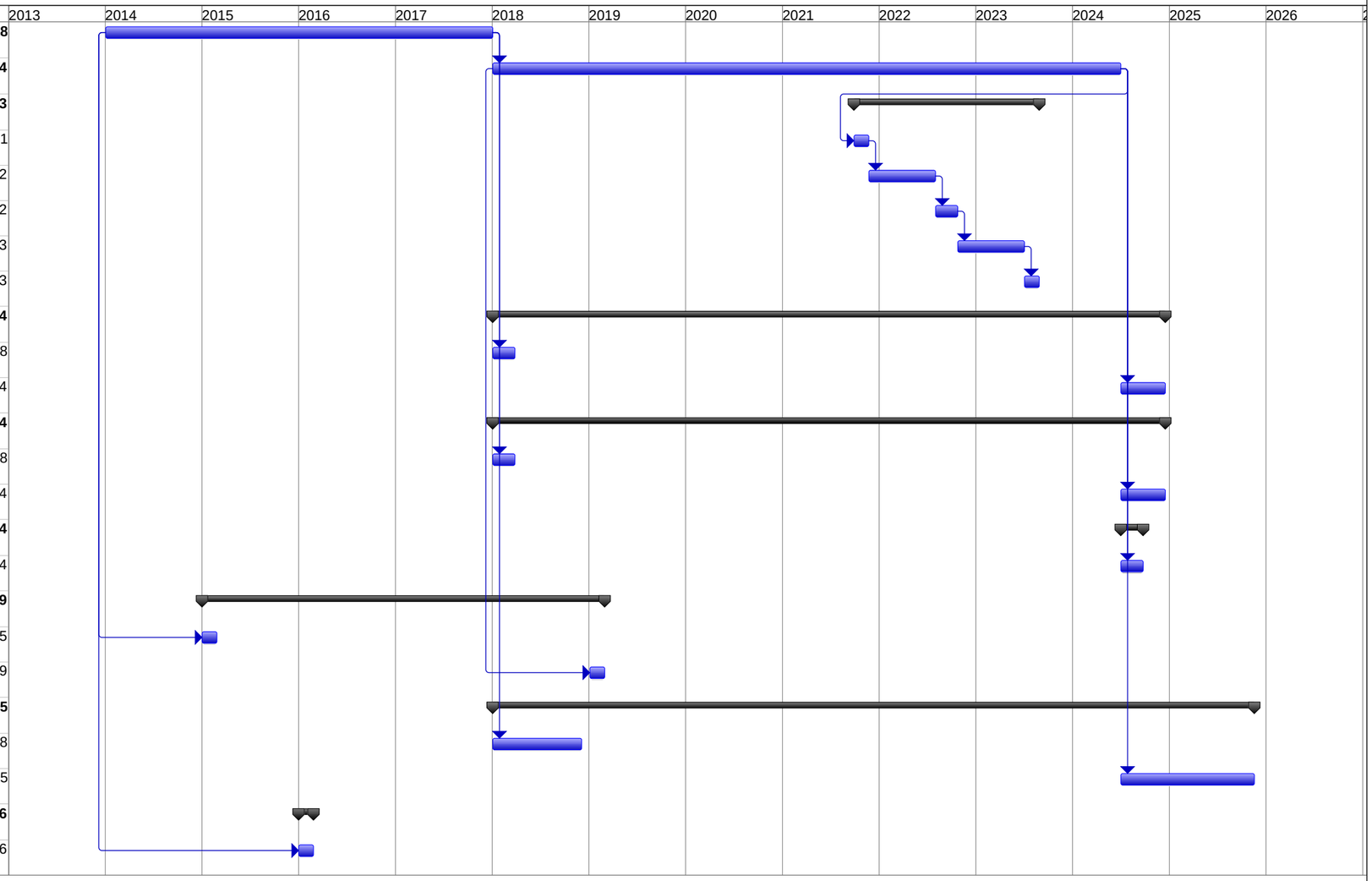
Scenerio C 1,250 lb/cy - 600,000 TPY January 16, 2014 Topographic Map										
Option	Gross Volume	Allowance for Final Cover	Net Volume	Tonnage per Year	Tonnage per Month	Volume per Month	Estimated Lifespan	Estimated Lifespan	Estimated End Date	Estimated Daily/Int. Cover
	CY	CY	CY	Tons	Tons	CY	Mo.	Years	Date	CY
Area A	8,577,600	533,976	8,043,624	600,000	50,000	80,000	100.5	8.4	Jun-22	2,091,342
Cell 3 Only	3,250,800	193,600	3,057,200	600,000	50,000	80,000	38.2	3.2	Mar-17	794,872

Appendix C

10-Year General Plan Schedule

Appendix C
City of Tucson
Los Reales Landfill Masterplanning
10-Year General Plan (1,200 lb/cy - 500,000 TPY)
November 2014

ID	Task Name	Duration	Start	Finish
1	**Task 1 Cell 3 - Interim**	**208.7 wks**	**Thu 1/2/14**	**Tue 1/2/18**
2	**Task 2 Area A**	**338.8 wks**	**Tue 1/2/18**	**Mon 7/1/24**
3	**Task 3 Cell 4 Development**	**500 days**	**Mon 9/27/21**	**Mon 8/28/23**
4	3.1 Select/Negotiate Eng. Contract	8 wks	Mon 9/27/21	Mon 11/22/21
5	3.2 Design (50, 75, 95, 100%)	36 wks	Mon 11/22/21	Mon 8/1/22
6	3.3 Bidding/Award	12 wks	Mon 8/1/22	Mon 10/24/22
7	3.4 Construction	36 wks	Mon 10/24/22	Mon 7/3/23
8	3.5 CQA Report/Approval	8 wks	Mon 7/3/23	Mon 8/28/23
9	**Task 5 Landfill Gas System**	**1814 days**	**Tue 1/2/18**	**Mon 12/16/24**
10	5.1 Extend Cell 3 Wells	12 wks	Tue 1/2/18	Tue 3/27/18
11	5.2 Extend Area A Wells	24 wks	Mon 7/1/24	Mon 12/16/24
12	**Task 6 Stormwater System**	**1814 days**	**Tue 1/2/18**	**Mon 12/16/24**
13	6.1 Cell 3 Controls	12 wks	Tue 1/2/18	Tue 3/27/18
14	6.2 Area A Controls	24 wks	Mon 7/1/24	Mon 12/16/24
15	**Task 7 Intermediate Cap**	**60 days**	**Mon 7/1/24**	**Mon 9/23/24**
16	7.1 Area A	12 wks	Mon 7/1/24	Mon 9/23/24
17	**Task 8 Fencing**	**1086.1 days**	**Thu 1/1/15**	**Fri 3/1/19**
18	8.1 Cell 3	8 wks	Thu 1/1/15	Wed 2/25/15
19	8.2 Area A	8 wks	Fri 1/4/19	Fri 3/1/19
20	**Task 9 Partial Closure**	**2054 days**	**Tue 1/2/18**	**Mon 11/17/25**
21	9.1 Cell 3	48 wks	Tue 1/2/18	Tue 12/4/18
22	9.2 Area A	72 wks	Mon 7/1/24	Mon 11/17/25
23	**Task 10 Access Roads**	**40 days**	**Fri 1/1/16**	**Thu 2/25/16**
24	10.1 South Entrance	8 wks	Fri 1/1/16	Thu 2/25/16



Appendix D

Estimated 10-Year Cash Flow Schedule

Appendix D
Los Reales Landfill Masterplanning
Estimated 10-Yr. Cash Flow