

Landfill Redevelopment Can Be Smart Growth

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Landfill Redevelopment Can Be Smart Growth

- Historical approach: Can't put buildings on a landfill
- Modern thinking: Intense land uses are possible, and lead to more active management of environmental controls
- Regulations and guidance are lagging practical experience

Landfill Redevelopment Can Be Smart Growth

- Many closed landfills have:
 - Good surface transportation access
 - Existing infrastructure
 - Urban and suburban corridors have extended to once-isolated landfill sites
- Redevelopment can improve post-closure care for landfills
 - Parking lots and buildings are maintained
 - Sites are visited more than quarterly

Challenges to Redevelopment of Closed Landfills

- Legal Issues
 - Strict liability concerns under Federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, or Superfund)
 - Similar concerns under state laws (Open Dump)
- Technical Issues
 - Gas mitigation
 - Foundation settlement
 - Worker Safety
- Costs

Bona Fide Prospective Purchaser

- All disposal of hazardous substances at the facility occurred before the person acquired the facility.
- All appropriate inquiries into the previous ownership and uses of the facility
- All legally required notices with respect to the discovery or release
- Full cooperation, assistance, and access

BFPP, Continued

- Institutional Controls
 - Complies with any land use restrictions established or relied on in connection with the response action
 - Does not impede the effectiveness or integrity of any institutional control
- BFPP not otherwise responsible party, and not affiliated (familial or corporate) with responsible party

BFPP, Continued

- The person exercises appropriate care with respect to hazardous substances found at the facility by taking reasonable steps to—
 - stop any continuing release
 - prevent any threatened future release
 - prevent or limit human, environmental, or natural resource exposure to any previously released hazardous substance.

Technical Concerns

- At a closed landfill site, “appropriate care” probably includes protecting against decomposition gas and maintaining integrity of cap
- Foundation and settlement issues
- Construction worker health and safety issues

Foundation and Settlement Issues

- Landfills settle differentially—depends on
 - Depth of fill, nature of waste
 - Trench versus area fill, compaction
 - Age of waste
- Hard to predict settlement. Empirical approach (settlement plates and surcharge) often better than guessing or modeling
- Structures on deep foundations (hard edges) may separate from surrounding land surface (soft edges)
 - Shear utility connections
 - “Watch your step!”

“Soft” Edge Settlement

- Waste compression varies
 - Depth, type, compaction....
 - Loading
- Drainage patterns change
 - Excessive grades
 - Undulations
 - Ponding and reverse flow directions
- Utility line grades change
 - Which way will sewage flow?
- Paving cracks develop
- Angular distortion for lighting, fencing, etc.



“Hard” Edge Settlement



Ground Improvement

- Excavate waste and replace with structural fill (\$\$\$)
- Reinforcement
 - Geogrids, other mechanical devices
 - Reduces abrupt differential settlement
 - Does not reduce total settlement



- Pre-loading (surcharging)
 - Old reliable method
 - Requires time and source of cheap fill
 - Allows settlement measurement & prediction

“Deep Dynamic Compaction”

- Brute force approach
- Areas should be level
- Depth of improvement ~25 to 30 feet in MSW
- Good for near surface stabilization
- Difficult on slopes

$$d_{\max} = n \times (W \times h)^{0.5}$$

**for soils, less for waste

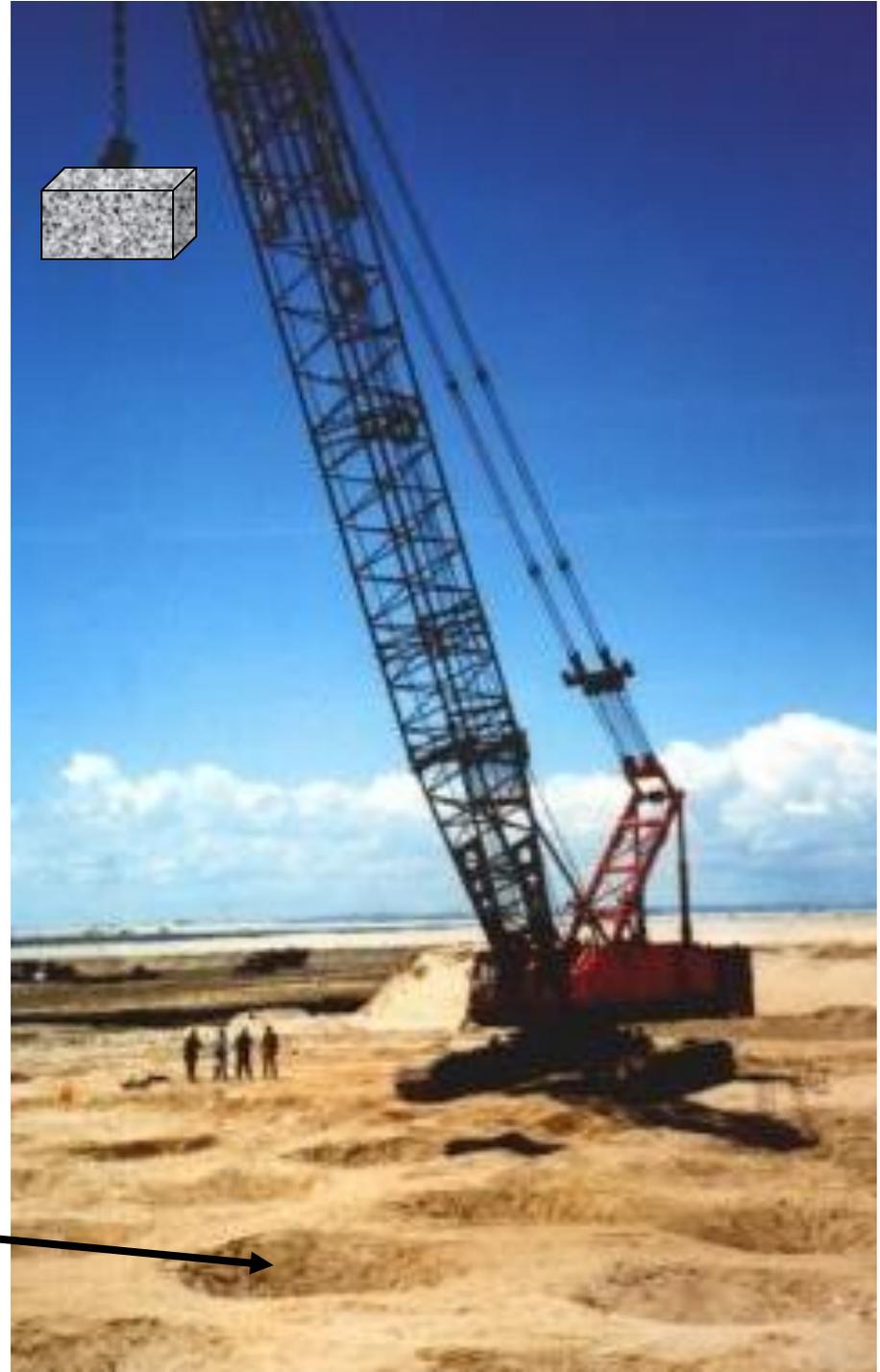
$$n = 0.3 - 0.5$$

W=weight (tons)

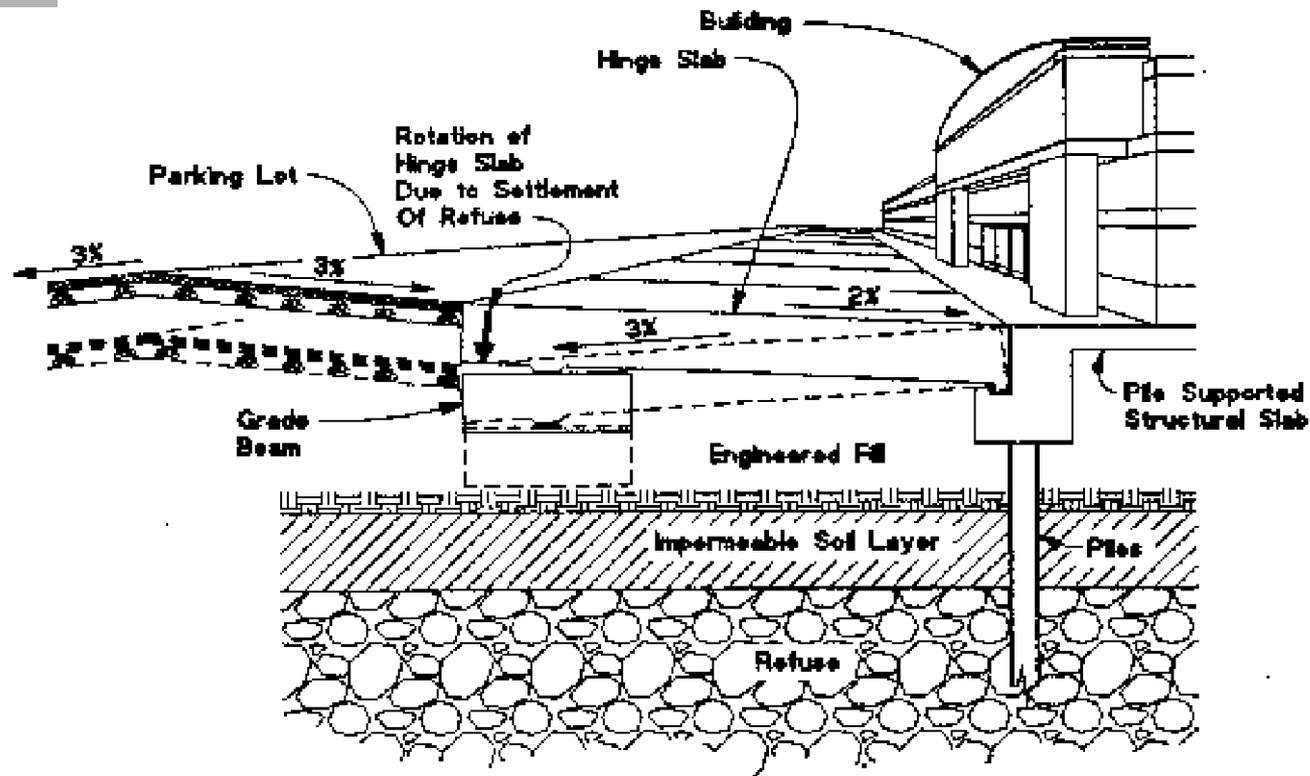
h=drop ht. (meters)

d_{\max} = 7 to 8 meters for 15 ton wt,
dropped 15 meters

Craters to be filled



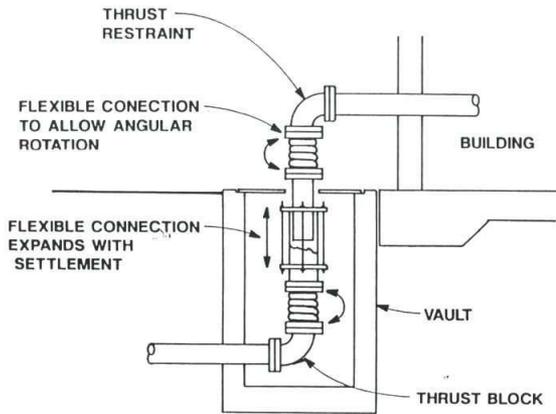




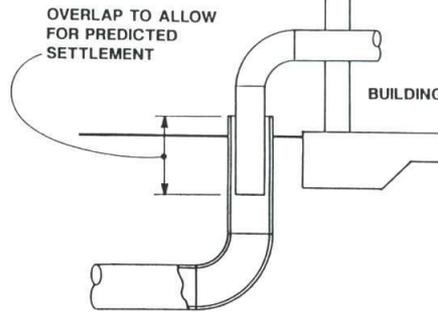
HINGE SLAB FROM CONSTRUCTION TO ONE HALF DESIGN SETTLEMENT (2'±)



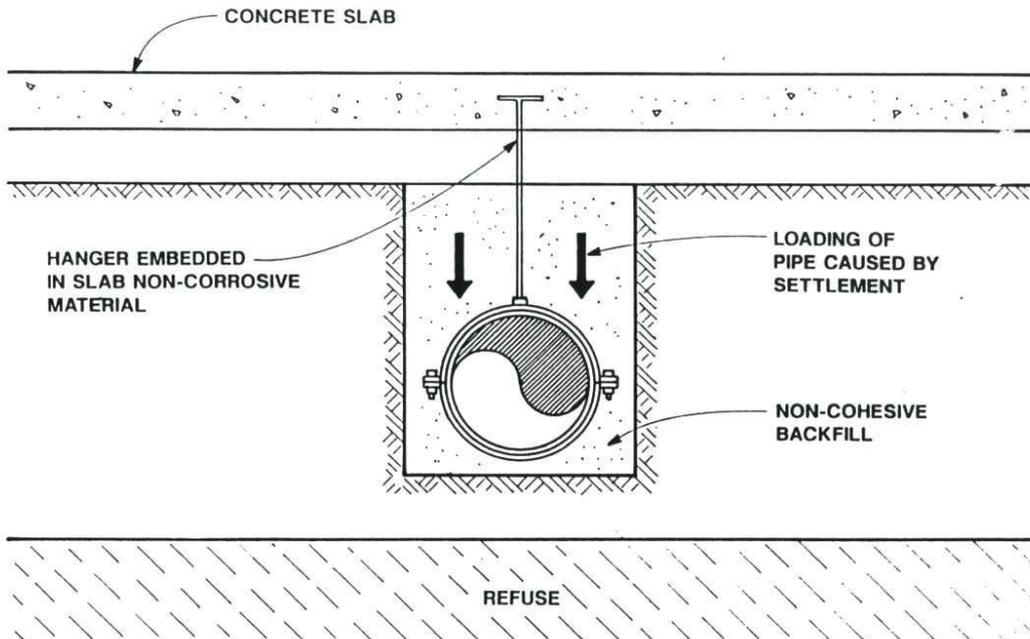




PRESSURE UTILITY



GRAVITY UTILITY



Utility Support & Sealing Systems



Landfill Gas Mitigation

- Nature of fill is important
 - Large quantity of relatively recent fill high in organics under anaerobic conditions may require elaborate gas mitigation
 - Small quantity of older fill low in organics can still produce gas, but probably in small volumes
- Nature of development also is important
 - Any occupied structure must be protected
 - Commercial development may be more suited to active controls (maintenance infrastructure)
 - Residential development can be challenging



Landfill Gas Mitigation

- Regulations and Guidance
 - Landfill regulations require factor of safety of four—methane must be less than 25 percent of the Lower Explosive Limit (LEL) in buildings
 - Wisconsin suggests no more than 25 percent of the LEL in soil gas (impractical)
 - Texas is only state with prescriptive statewide regulations (Subchapter T)
 - Local building officials handle through specific ordinances (Los Angeles, Alexandria) or fire marshal review—higher factors of safety (e.g., 10 or 20) are typical



PASSIVE EXAMPLES



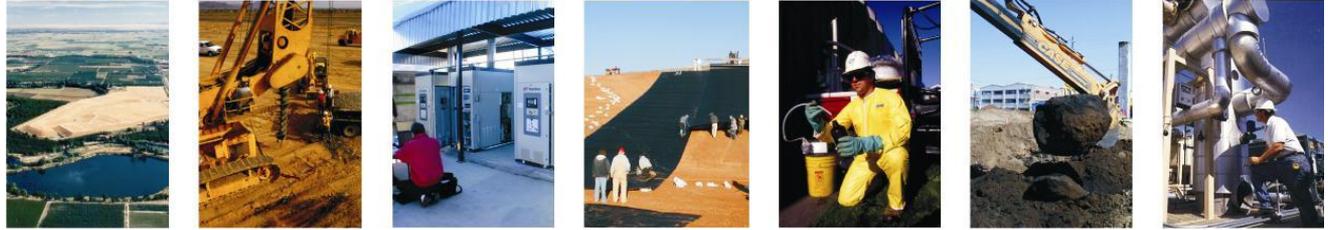


Construction Worker Health and Safety Issues

- Older landfills may contain industrial & hazardous wastes
 - Sludges, dusts, residues
 - Drums of liquids or semi-liquids
- Federal and State regulations, industry guidance (e.g., SWANA Safety Guidelines) and prudence require caution
 - Written health & safety plans
 - Air monitoring
 - Contingency plans
 - Notification may be required (e.g., asbestos NESHAP)

Construction over Landfills Can Cost More

- Structural slabs and deep pile foundations for typical retail or office park development can add \$12 to \$25 per square foot of building or more
- Deep dynamic compaction for parking areas can add \$1 per square foot of treated area or more
- Passive gas protection system can add \$2.50 to \$6.00 per square foot of building footprint or more
- Maintenance cost for parking areas, etc. is higher

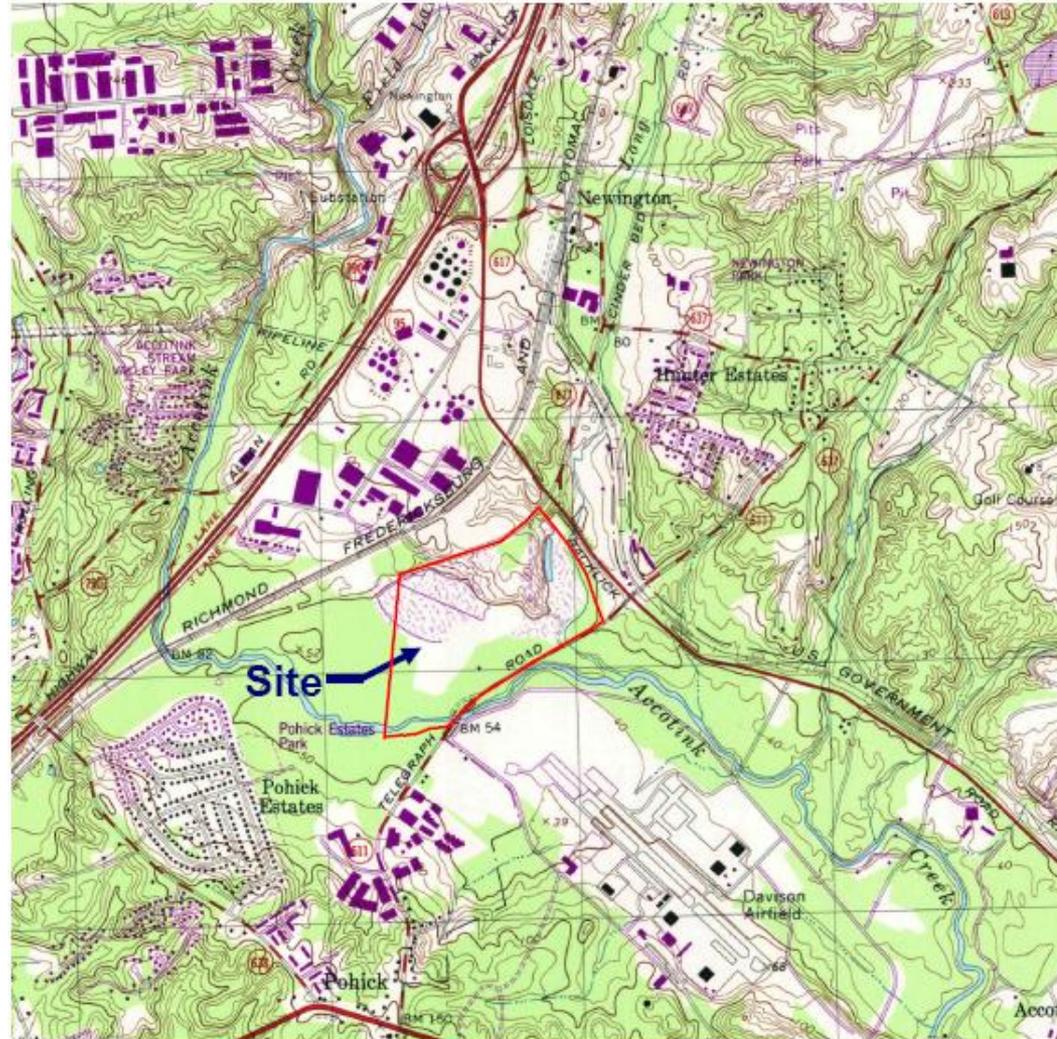


Belvoir Business Center (Former BFI Telegraph Road Landfill) Newington, VA

Client: Scannell Properties

Site Background

- Site is former BFI C&D landfill that operated between 1977 and 1984
- Backfilled into sand and gravel pit with clay fines as bottom layer
- Entire parcel is 134 acres (mostly floodplain), with landfill covering about 60 acres in two mounds (“east” and “west”)
- Washington Gas transmission line right of way between waste mounds
- Waste is 35 to 50’ deep, covered with 3’ to 6’+ soil cap



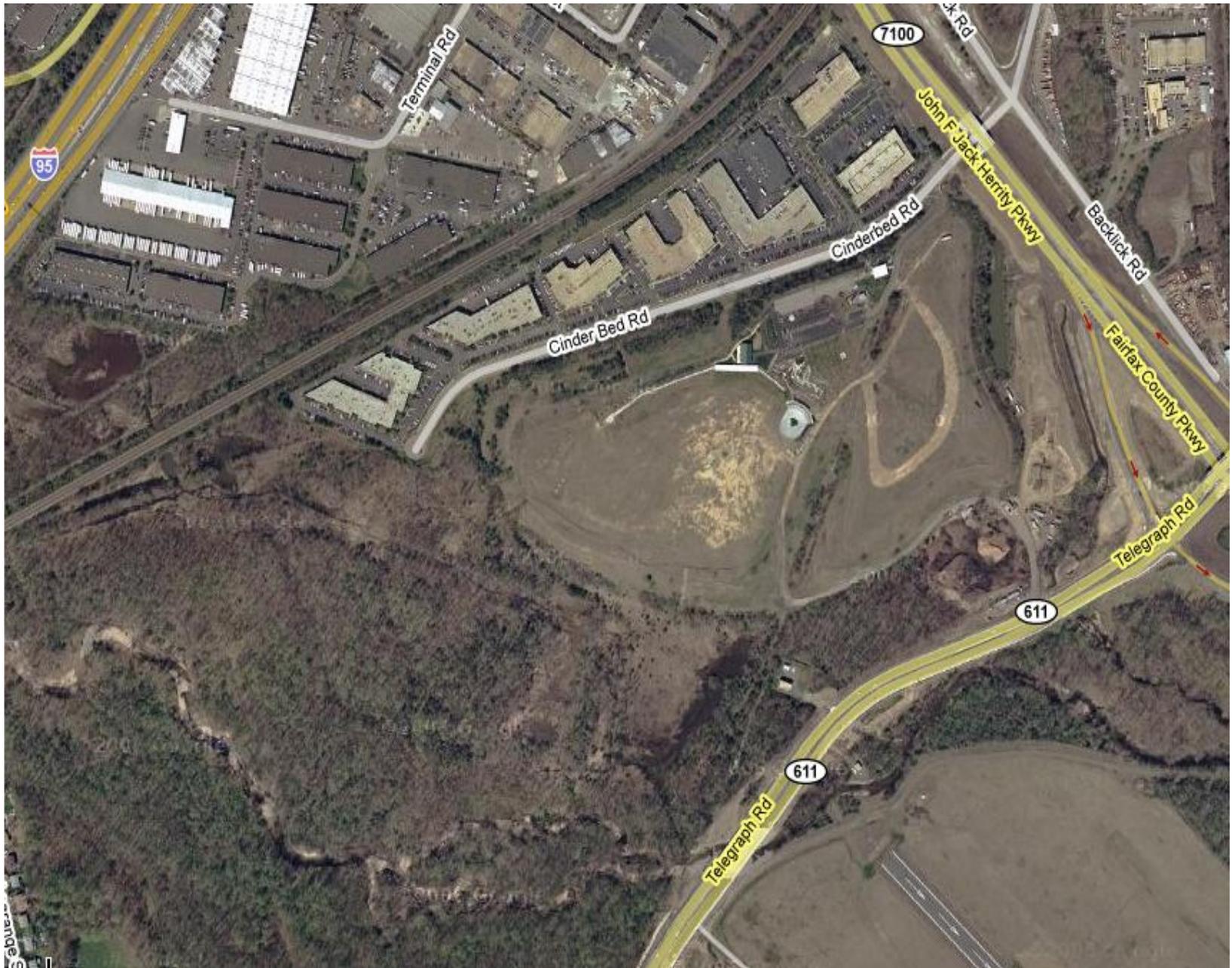
Contour Interval: 20'



Scale in Feet

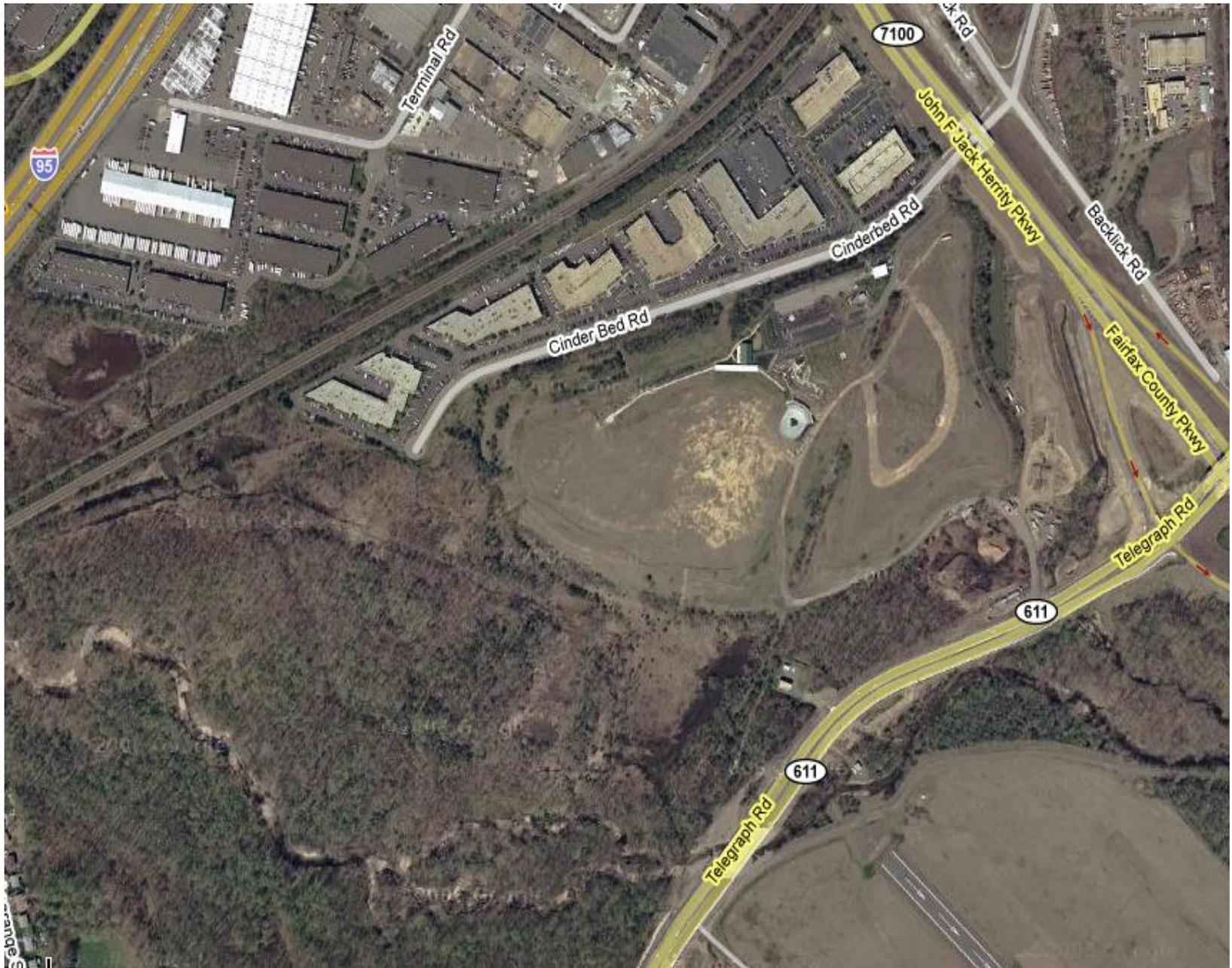
Former Telegraph Road Landfill Lorton, Virginia

Source: Fort Belvoir, VA USGS 7.5-minute Topographic Map, 1965, photorevised 1983



Site Background

- Active SWF permit for gas extraction and flare system (operated 16 hours per week before decommissioning)
- Leachate drains are connected to public sewer
- Site is beyond 20-year moratorium imposed by Fairfax County ordinance for redevelopment of closed landfills
- Site was developed as sports park about 12 years ago (now defunct)
- West mound lies in approach path to Davison Army Airfield (Ft. Belvoir)

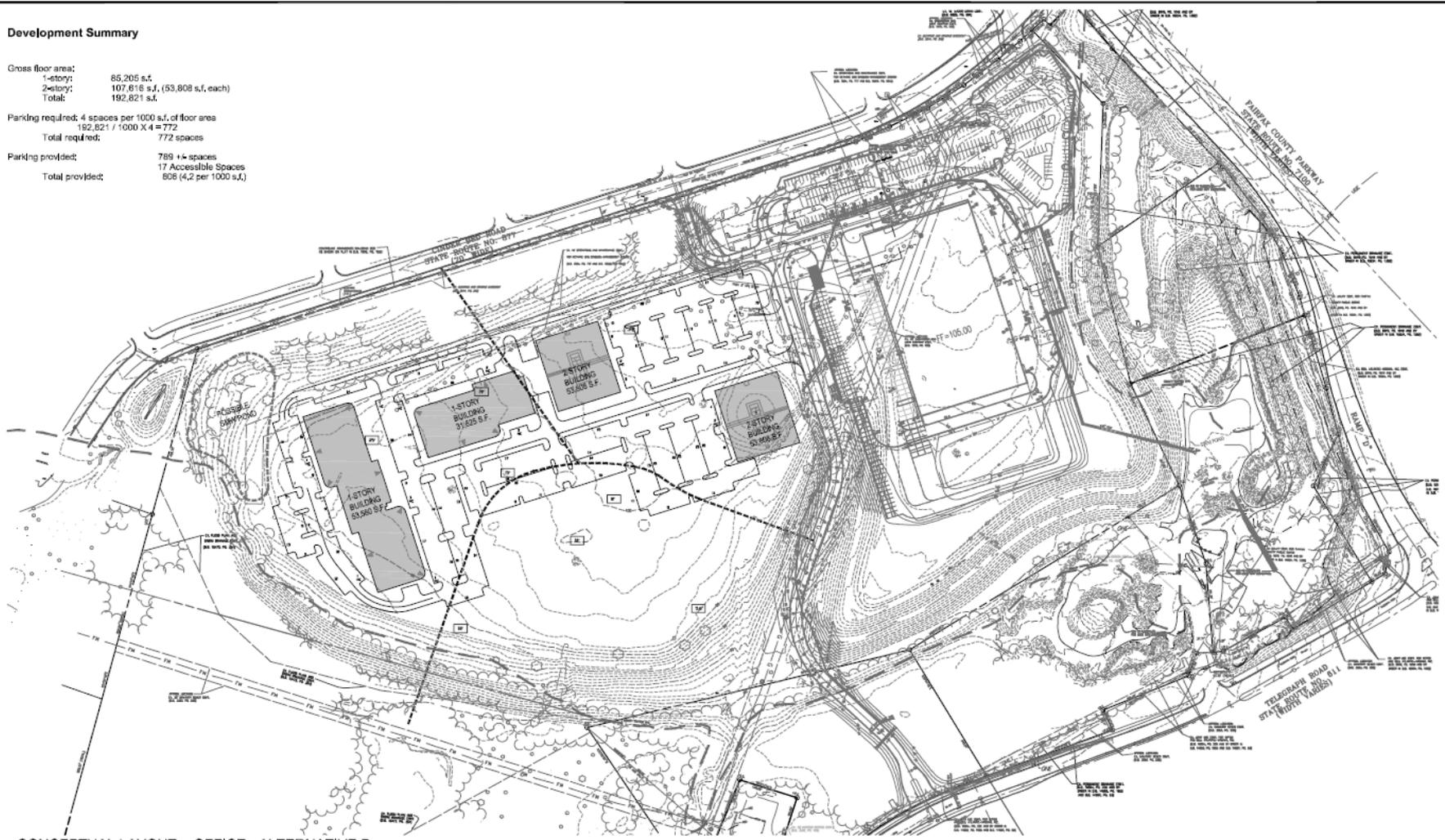


Development Summary

Gross floor area:
 1-story: 85,205 s.f.
 2-story: 107,616 s.f. (53,808 s.f. each)
 Total: 192,821 s.f.

Parking required: 4 spaces per 1000 s.f. of floor area
 $192,821 / 1000 \times 4 = 772$
 Total required: 772 spaces

Parking provided:
 789 + 6 spaces
 17 Accessible Spaces
 Total provided: 806 (4.2 per 1000 s.f.)



CONCEPTUAL LAYOUT - OFFICE - ALTERNATIVE B



ROBINSON PROPERTY

Fairfax County, Virginia



Scale: 1" = 100'
 April 20, 2008

Urban, LLC - U:\Arch\Robinson Property\CONCEPT OFFICE - ALT B.dwg [Drawn: JAW/6/11] May 01, 2008 - 2:29pm (page 6)

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Smart Growth

- BRAC is bringing some 20,000 new jobs to Ft. Belvoir, and need for office space is acute
- Good transportation, with Fairfax County Parkway and Telegraph Road adjoining
- 110,000 sf FedEx Ground facility on east mound, with about 200,000 sf office on west
- West mound lies in approach path to Davison Army Airfield (Ft. Belvoir)

Highlights

- Entered into Virginia Voluntary Remediation Program (VRP)
 - Required appeal to Director of DEQ (due to active SWF permit)
 - Also obtained BFPP Brownfields letter
- Site characterization included groundwater, surface water, sediment, soil vapor, gas, and waste sampling and analysis
- Risk assessment found major risk to be control of methane migration into structures
- Methane mitigation to include redundant passive membrane and active sub-slab ventilation

Highlights

- Gas migration control following closure of active gas extraction and flare system, as needed, will be combination of solar fan vents and utility trench dams
- Buildings on pile foundations with active methane mitigation systems (sub-slab ventilation)
- Divided the site administratively into two VRP sites (eastern and western mound)
- Much concern raised by VRP staff regarding ecological risk

Highlights

- Two Remediation Waste Management Unit (RWMU) designations for portions of the site obtained from VDEQ (one for each mound)
 - Allows re-placement of excavated waste in a RWMU area onsite
 - Requires periodic sampling to confirm wastes are not hazardous
 - If 6,000 CY of wastes disposed in eastern RWMU instead of offsite, greenhouse gas emissions reduced by 12 tons
 - If 50,000 CY of wastes disposed in western RWMU instead of offsite, greenhouse gas emissions reduced by 100 tons
- Solar fans on perimeter vents control landfill gas migration

Former Active LFG Extraction System



Solar-Powered Fans



Remediation Waste Management Unit



Eastern Mound for FedEx Ground



Eastern Mound for FedEx Ground



Eastern Mound for FedEx Ground



Future Work

- Repairs to leachate discharge line (under new access road)
- VRP Certificates
 - Eastern Mound “soon” with public notice completed
 - Western Mound after building construction
- Post-Certificate monitoring of groundwater and surface water quality