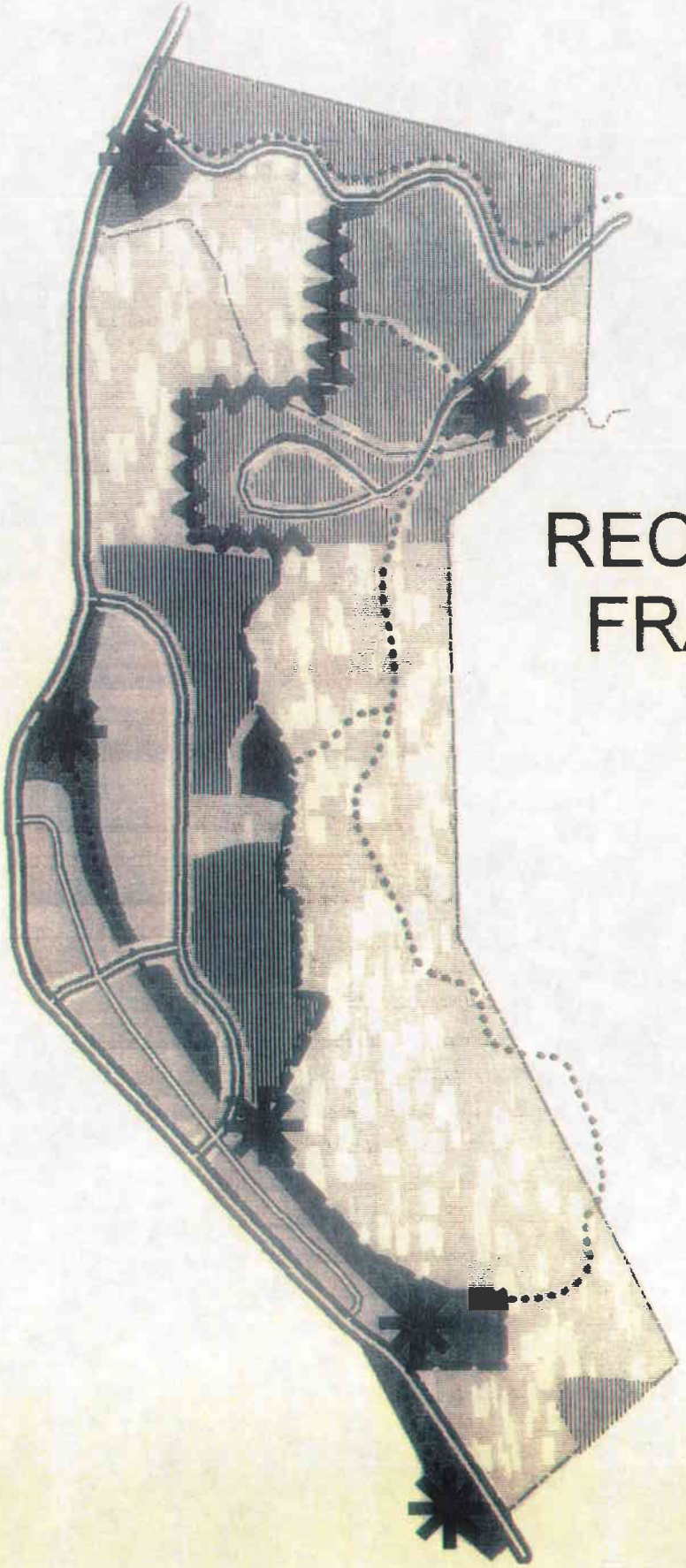

BECK STREET RECLAMATION FRAMEWORK AND FOOTHILL AREA PLAN

Prepared by

Dames and Moore
Landmark Design, Inc.
Wikstrom Economic & Planning
Stephen Goldsmith

for

Salt Lake City Planning
and
North Salt Lake City

BECK STREET
RECLAMATION FRAMEWORK
&
FOOTHILL AREA PLAN

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City of North Salt Lake

Planning Commission Recommended November 20, 1997

Adopted by the Salt Lake City Council September 21, 1999

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1.0 INTRODUCTION

1.1 ORGANIZATION OF THE PLAN

The Beck Street Reclamation Framework and Foothill Area Plan is presented in five chapters.

Chapter One introduces the topic and explains the plan organization. Included is background information, a description of project goals, a brief summary of the planning process, and a description of the public participation and consultation process.

Chapter Two presents the plan proposals. The chapter is divided into seven main sections that address land use, zoning, open space and trail preservation, site enhancements and aesthetics, and standards for the excavation industry. The chapter is concluded with an action plan that summarizes the proposed implementation schedule.

Chapter Three documents the existing conditions that were considered during the preparation of the plan. These are divided into seven broad sections that address natural and environmental conditions, spatial and visual conditions, transportation and access, land ownership, land use and zoning, sand and gravel operations, and economic conditions.

Chapter Four documents the alternatives that were considered and how they were evaluated. The alternatives are presented in categories of land use, site enhancement and aesthetics, economics and reclamation.

Chapter Five summarizes the guiding principles that emerged from the preferred alternatives, and how these evolved into the plan proposals presented in Chapter Two.

1.2 PROJECT BACKGROUND

One hundred years ago when excavation originally began along what is now Beck Street, the area was rural and separated from urban activity. Since then, the surrounding communities have grown and developed, and today excavation operations are taking place in a highly visible and rapidly growing urban area.

Rock aggregate is a diminishing asset that will eventually be exhausted. Once this happens along the Beck Street foothill, different uses will replace current excavation operations. For years local governments have debated how to control Beck Street excavation activities through zoning and other legislative means. The City of North Salt Lake and Salt Lake City are both concerned that minerals are excavated in a manner that considers the long-term need of reclaiming excavated land along Beck Street while preserving the important bench lands above.

In April 1995, Salt Lake City was in the process of finalizing a major rewrite of its Zoning Ordinance. The new Ordinance recognized that a majority of the land east of Beck Street was occupied by uses related to the excavation, processing and sales of sand and gravel. Accordingly, a new zoning classification was developed, the Extractive Industries Zone (EI), to recognize and specifically address these uses. The boundaries of the new zone were drawn to include, as far as could be determined at that time, all properties where excavation was actually occurring.

Unknown to Salt Lake City at the time, Staker Paving & Construction Company and Hughes and Hughes Investment Company were planning to expand their excavation operations eastward into property which had not been considered for Extractive Industries (EI) zoning. A process was thereupon initiated to evaluate re-zoning property owned by Staker and Hughes Companies. At nearly the same time, the City of North Salt Lake was establishing a master plan for its bench portion of its extraction operations. This pointed to the obvious need to address issues related to all extractive industries along Beck Street, as well as issues concerning the foothills above.

In order to address the long-term operation of sand and gravel industries along Beck Street, as well as to try to reach some consensus concerning the future land use of the entire Beck Street area, the City of North Salt Lake and Salt Lake City contracted the studies presented in this report.

1.3 PROJECT PURPOSE AND GOALS

The main purpose of this plan is to establish a framework for achieving the following goals:

GOAL 1 To develop standards for the sand and gravel industry that ensure the hillside is left in a condition that does not adversely affect adjacent properties nor result in unsafe and unusable land after excavation is complete.

GOAL 2 To provide opportunities for meaningful public involvement to balance the various interests of the cities, the general public, sand and gravel operators, property owners, and nearby residents and businesses.

GOAL 3 To provide economically viable alternatives for open space preservation on the bench in consideration of future land use and property ownership.

GOAL 4 To recommend a plan for long term and short term improvements for Beck Street as an important gateway between Salt Lake City and the City of North Salt Lake.

1.4 PLANNING PROCESS AND PUBLIC PARTICIPATION

The Beck Street Reclamation Framework and Foothill Area Plan was developed by the Consulting Team in conjunction with a twenty-six member Citizens Advisory Committee consisting of representatives of local governments, local landowners and excavation operators.

As detailed in Appendix A, public input has been a major cornerstone of the planning process and has lead directly to the formulation of goals, policies and strategies. Opportunities for public input has occurred at several different junctures. The general public was invited to participate in scoping meetings held in December 1996 to identify issues, concerns and develop a vision for the project. The public was also invited to attend an open house held in late April 1997 to review alternatives, and again in September 1997 to review draft proposals.

2.0 THE PLAN

2.1 PROJECT AREA

The Beck Street Reclamation Framework and Foothill Area Plan study area is situated on the northern edge of Salt Lake City and the southernmost portion of the City of North Salt Lake. The study area commences in Salt Lake City at approximately 900 North and terminates at the junction of US 89 and Orchard Drive in the City of North Salt Lake. The study area stretches east from Beck Street to the eastern limit of the Bonneville Terrace for an average distance of 1.5 miles.

As illustrated in Figure 1, the site is divided along the Salt Lake/Davis County border. Land north of the border is located in the City of North Salt Lake, south of the border is in Salt Lake City. The site is also divided vertically, with the Bonneville Bench lying approximately 400-700 feet above Beck Street to the west.

A variety of geologic, climatic and biologic events have helped to form and shape the mountainside. In recent times the actions of man have continued this process of alteration. As parts of the hillside between the bench and Beck Street have been removed through excavation, the mountain has been transformed into the built environment of the surrounding civilization. Nearby cities and towns have quite literally grown out of the mountain, which is preserved in their roads, sidewalks, buildings and other built features.

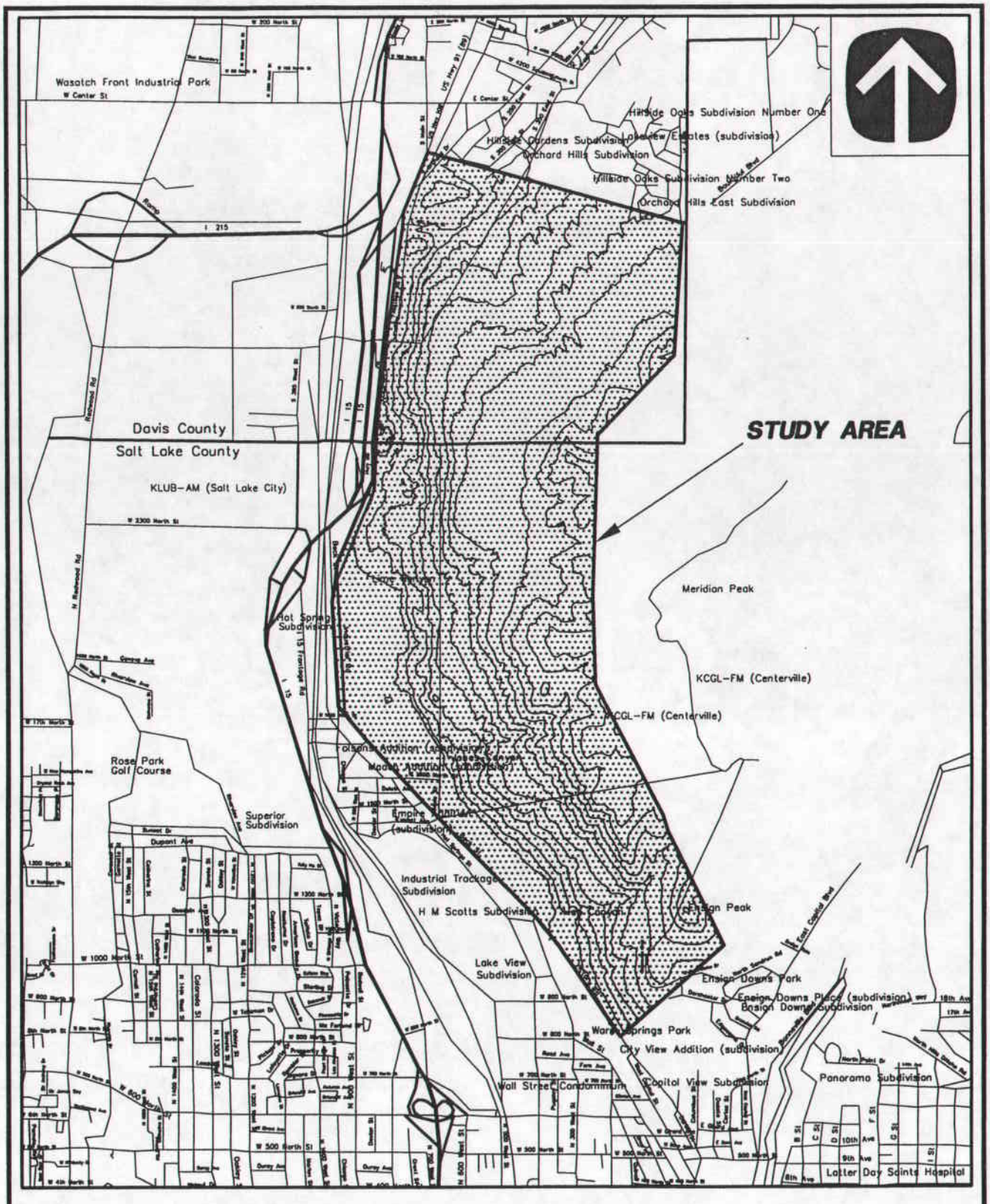
2.2 PREFERRED LAND USE

The preferred land uses reflect a long-term (50 year +) vision for the area, once excavation has ceased and post-excavation mitigation has been implemented. One of the main intents is to integrate and connect future land uses, both vertically (from Beck Street to the Bonneville Bench) and horizontally (between Salt Lake City and the City of North Salt Lake). As illustrated in Figure 2, the preferred land uses focus on open space and residential uses in the City of North Salt Lake, with open space and business park development being the main focus in Salt Lake City.

2.2.1 General Concepts

Access and circulation should occur along a continuous, inter-linked system of roads and trails. A new road proposed for the northern portion of the study area provides access to existing and proposed "open space residential" uses in North Salt Lake. Buffers are proposed along the boundaries of visually unattractive uses to protect adjacent uses, especially the "open space residential" areas proposed for the City of North Salt Lake. All new and existing major roads should be designed as parkways with landscaped medians, trees and other streetscape features.

A major business park is proposed along the lower excavated slopes adjacent to Beck Street in Salt Lake City. Chicago Street should be upgraded to serve as the main entrance



BECK STREET STUDY AREA

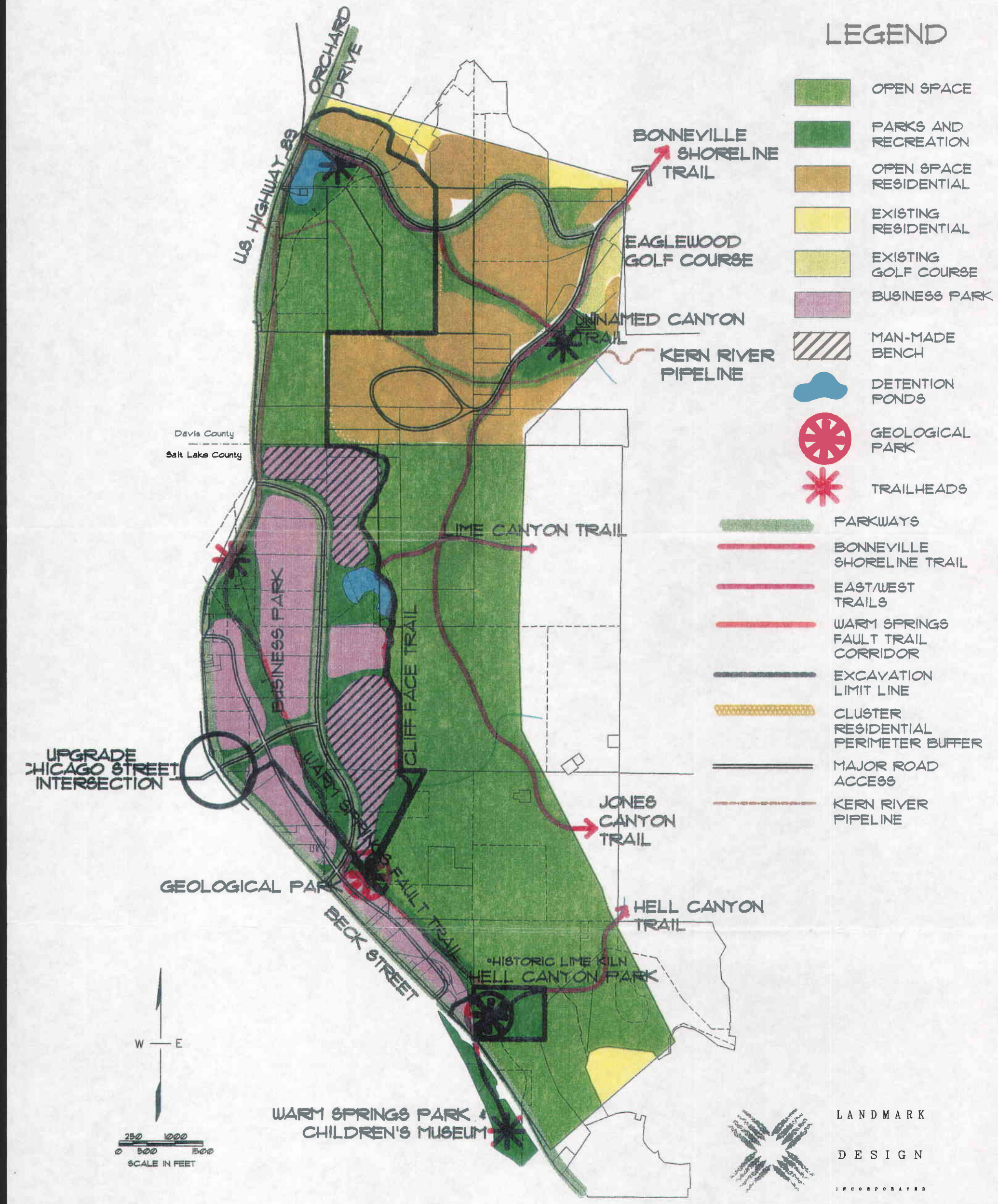
DAVIS AND SALT LAKE COUNTIES, UTAH

Dames & Moore

FIGURE 1

BECK STREET RECLAMATION FRAMEWORK AND FOOTHILL AREA PLAN

FIGURE 2 PREFERRED LAND USE



LANDMARK DESIGN INCORPORATED

to the business park and as a future gateway for Interstate 15. Parks, parkways and open spaces should be major components of the business park.

Large regional parks are proposed at the mouth of Hell Canyon, near the upper reaches of Unnamed Canyon and just south of the intersection between US 89 and the proposed northern access road in the City of North Salt Lake. A special Geologic Park is proposed within the business park near the remnants of Jones Canyon.

The Bonneville Shoreline Trail should be designated as a permanent trail corridor, linked to the west via trails at Unnamed Canyon, Lime Canyon, Jones Canyon and Hell Canyon. A second north-south trail system is proposed along Warm Springs Fault between Hell Canyon and the new access road in the north. Special features of this trail include a park/trailhead located at Hell Canyon, a Geological Park/trailhead located at Jones Canyon, and a trailhead located in the business park. Additional trailheads are proposed at Warm Springs Park, at the base of the new access road and at Unnamed Canyon Park. The primary east-west trail system connection will follow an excavated cliff face from the lower reaches of Jones Canyon to the upper remains of Lime Canyon, and eventually to the Bonneville Shoreline Trail.

Storm water detention ponds are proposed at the base of Unnamed Canyon near Beck Street and at the bottom of Lime Canyon at the base of the excavated cliff face. The detention ponds should enhance the visual and environmental appeal of the area while serving as a potential irrigation source for nearby parks and open spaces.

2.2.2 City of North Salt Lake

Residential uses are proposed along the Bonneville Bench. Circulation should be provided by a new access road that links the bench with Highway 89 and destinations beyond. A connecting loop road at the top of the bench should link with the new access road, providing access south of the main access road.

Cluster development principles should be applied to new residential development on the bench, supporting the formation of an "open space community". These principles should build on residential development ideals adopted for the community. These include limiting densities through minimum lot sizes and prohibiting development on slopes which exceed thirty percent. Open space linkages should be provided within the residential neighborhoods and along the outer perimeters to help integrate the new neighborhoods with the surrounding environment.

In order to demarcate a positive transition between the two cities and preserve a diminishing natural resource, the lower reaches of the North Salt Lake segment should be dominated by open space. All public lands, land not currently granted excavation rights and land with grades in excess of 30 percent are proposed for open space uses. All existing and future excavated slopes are also proposed to be rehabilitated as open space as

part of the post-excavation mitigation procedure.

Parkways are proposed alongside Highway 89 and the new access road. These should include generous landscaping and pedestrian facilities such as trails and sidewalks. Trails are also proposed at Unnamed Canyon and within the Kern River pipeline development buffer. The Bonneville Shoreline trail should be extended through residential areas within a designated corridor. This corridor should be a minimum width of 30 feet and located in a right-of-way that is separate from any required road right-of-way.

The Kern River pipeline should be maintained within a corridor which guarantees that required side-slopes meet industry safety and environmental standards. Adequate buffers should be applied when the pipeline is adjacent to residential land in order to meet industry safety standards

Except for areas intended as permanent detention/retention ponds or other water impoundments, any affected land which has been lowered to an elevation below the nearest elevation at Highway 89 as a result of mining operations shall be restored, through backfilling and compaction, to an elevation equal to or higher than the nearest elevation at Highway 89.

2.2.3 Salt Lake City

A business park is proposed from the Beck Street/Victory Road intersection northward to the county line, extending eastward to the base of the excavated slope. The main access into the business park is from the Beck Street and Chicago Street intersection, which should be upgraded with a 4-way traffic light in the short-term, and possibly linked directly to Interstate 15 in the long-term. Additional connections to the business park are provided north and south of the Chicago Street intersection at intervals of approximately one mile.

The business park should be designed in campus fashion and include parks, parkways, open space and trails. In order to promote a more cohesive development pattern and encourage better traffic circulation, no individual lot access should be allowed from Beck Street.

The central portion of the business park is envisioned to be developed from "scratch" as extraction industries disappear. "Alluvial fans" should be sculpted from the hillside as part of the excavation process, providing a man-made bench that will enhance the overall development potential of the area. A detention pond is proposed at the base of the excavated portion of Lime Canyon beneath the cliff face. Natural runoff should be collected and utilized as a water feature and irrigation resource.

Except for areas intended as permanent detention/retention ponds or other water impoundments, any affected land which has been lowered to an elevation below the

nearest elevation at Beck Street as a result of mining operations shall be restored, through backfilling and compaction, to an elevation equal to or higher than the nearest elevation at Beck Street.

The southern portion of the business park is designated as a site improvement area for existing operations and uses. At present this area is almost fully excavated. As existing uses transform from industrial to mixed-use business uses, the sites should be modified as part of the overall business park development scheme. A service road should link this portion of the business park to the central portion.

The Bonneville Bench should be maintained as open space, and the Bonneville Shoreline Trail formalized within a designated corridor. East-west trail connections between the Bonneville Shoreline Trail and Warm Springs Fault Trail are proposed along Hell Canyon, Jones Canyon and Lime Canyon. A diagonal Cliff Face Trail will traverse the excavated mountain face between upper Lime Canyon and lower Jones Canyon. The Cliff Face Trail is envisioned to become the primary east-west trail connection between the Beck Street business park and the Bonneville Bench.

A large regional park is proposed at the mouth of Hell Canyon. The park will be developed as a trailhead to the Bonneville Shoreline Trail via Hell Canyon and Cliff Face Trail. Hell Canyon Park will also be linked to the Geologic Park along the Warm Springs Fault Trail, which should be maintained as minimum 200-foot open space corridor (100 feet on either side of the fault line). Additional trailheads should be developed along Warm Springs Fault Trail at the Geological Park, near the northern extent of the trail at Beck Street, and at Warm Springs Park just beyond the study area boundaries. The historic Lime Kiln near Hell Canyon Park should be preserved and incorporated into the design of the park.

2.3 PROPOSED ZONING

In order for the envisioned land uses to be realized, it will be necessary to implement some zoning changes. It is essential that these changes mirror the intended land uses, regardless of the jurisdiction in which they occur. Since some existing uses will continue to operate well into the future, special care should be placed on the timing and phasing of each zoning change.

2.3.1 City of North Salt Lake

Specific land trade negotiations are currently underway in the City of North Salt Lake related to residential development in the Bonneville Bench area. Although the specific location of some preferred uses may deviate from those presented in this plan, the spirit and intent of the preferred land use plan should guide future development in the area.

In the short term, residential zoning should be maintained in areas earmarked for residential development. These residential zones should encourage open space residential

uses that utilize clustering techniques and support the integration of unique natural features, open space and trails. Perimeter buffers should be encouraged as appropriate and desirable.

Existing extraction industries should be zoned accordingly. Extractive industry zones should reflect the recommendations of this plan, including all site alignments, perimeter buffers, excavation limits, finished slopes and post-excavation mitigation measures. Small pockets of commercial land may be feasible along Beck Street in the long-term, but in general the area is not envisioned to support large amounts of commercial development. Existing Commercial (CH) zoning should therefore be changed to open space zoning in support of the preferred land uses.

The trailhead/park at the base of the new access road, the proposed regional park at Unnamed Canyon and Eaglewood Golf Course should be zoned for parks and recreation uses. The Bonneville Shoreline Trail should be designated as an official trail corridor in the short-term. The trail should be guaranteed through the designation of a minimum 30-foot wide corridor through all public and private properties via dedications, exchanges, conservation easements, purchase of development rights and fee title or other appropriate measures (see Section 2.4 for details). All land that is in public ownership, with natural slopes in excess of 30 percent and which is not earmarked for excavation should be zoned as open space.

In the long term, all land earmarked for excavation should be re-zoned as open space once excavation operation and post-excavation mitigation measures are complete. Excavated slopes with finished grades less than 50 percent (1:2) should be re-vegetated according to the reclamation standards detailed in Section 2.6.

2.3.2 Salt Lake City

In the short-term (0-10 years), the existing zoning should be maintained with the exception of the ridge line behind the Staker, Hughes, Monroc and Mary Clarke properties, which should be modified to reflect an agreed-upon open space/extraction configuration as discussed at the end of this section. The Bonneville Shoreline Trail should be designated as an official trail corridor in the short-term. The trail should be guaranteed a minimum 30-foot wide corridor through all public and private properties via dedications, exchanges, conservation easements, purchase of development rights, fee title or other appropriate implementation measures as detailed in Section 2.4. Warm Springs Fault Corridor should be officially designated as open space within an official 200-foot wide corridor, via dedications, exchanges, conservation easements, purchase of development rights, fee title or other appropriate measures as detailed in Section 2.4.

Land currently zoned for manufacturing should be modified to accommodate business park uses. This change is essential in the long-term, but can potentially occur at any point in the future. Extraction Industry zones located in the central portion of the site

should also be re-zoned in the long-term to accommodate business park uses when extraction operations are complete. These rezoning efforts could involve a Transfer of Development Rights (TDR) as discussed in Section 2.4. Properties should therefore not be automatically rezoned without first reviewing the trade-offs between full excavation and the development potential/value of the business park

Business park zoning should encourage cluster development that integrates unique natural features, open space, water resources and trails as basic site elements, and discourages direct lot access from Beck Street. It is recommended that maximum development levels be established that could be exceeded only in exchange for reduced future excavation. As the southernmost extraction industry zone is depleted, it should be changed to open space zoning in support of the proposed regional park at the excavated mouth of Hell Canyon.

Definition of the east zoning boundary for extractive industries within the central portion of the Project Area (Mary Clarke, Hughes and Hughes, Staker Paving, Monroc) has been a prime focus of this Plan. The siting of this boundary has direct and major effect on the volume of material that can be mined (Section 3.7), the area preserved as open space of the Bonneville Bench (Section 2.4), and the view-shed as seen from the Bonneville Shoreline Trail and from areas to the west (Section 3.2 and 4.3).

Discussions within the Steering Committee and feedback received from the public involvement process brought out the following:

- The representatives of the gravel mine operators within the Steering Committee were willing to compromise and cooperate on several of the main plan elements (Gateway road treatments and preservation of the Bonneville Bench, for example) as long as there was a general recognition of their economic concerns. The most notable desire of the operators was related to being able to extract a reasonable, unspecified, tonnage of rock from their property.

- Preliminary calculations of tonnage that could be extracted if the western slope were flat enough to be vegetated showed this tonnage to be less than half the tonnage that could be extracted for steeper, yet physically safe slopes within the same properties.

- The representatives of the public agencies on the Steering Committee and other citizens who participated in the Steering Committee meetings and the public involvement process, given the economic reality, had a clear preference for preservation of a maximum possible area of Bonneville Bench versus an alternative for preserving excavated slopes flat enough to be theoretically revegetated.

- A Steering Committee meeting was held at the Bonneville Bench where the committee drew a boundary on a contour map which preserved the entire Bonneville

Bench surface area within the Mary Clarke, Hughes and Hughes, and Staker Paving properties, and which also preserved the view of the Bench surface from the Bonneville Shoreline Trail (Figure 3.)

2.4 OPEN SPACE AND TRAIL CORRIDOR PRESERVATION STRATEGIES

Six strategies for open space and trail corridor preservation are presented in this section. The applicability of each to specific sites is also indicated. A description of property parcels likely to be affected by the various strategies is listed in Appendix 'B'.

2.4.1 Strategy One: Land Use Plans That Encourage Open Space

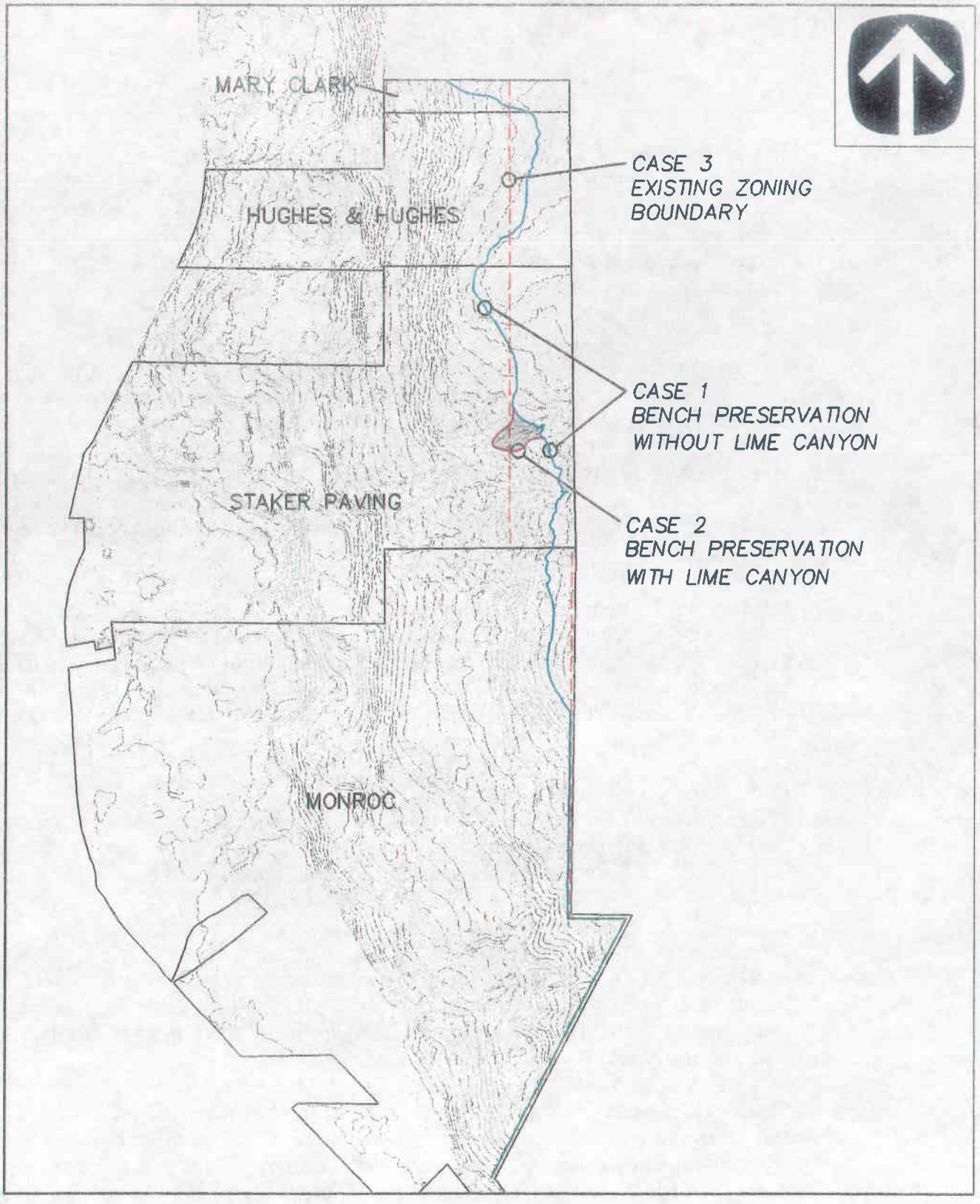
An important first step to preserve valuable open space and trail corridors is to define the extent of local public interest in preservation. This step is normally part of the general planning process of the local community. In Salt Lake City, the existing land use plan for the Bonneville Bench reflects a desire to preserve open space. As part of this study, preferred land uses have emerged for the City of North Salt Lake bench which support cluster residential development that is integrated with open space and trails access. Along the Beck Street level of both communities, post-excavation properties are proposed which incorporate open space, parks, and trail corridors. These features provide access to the recreational and open space experience on the bench above via trails and trailheads.

Project-Area Application

Salt Lake City has open space preservation mechanisms in place which cover the study area. The Salt Lake City Open Space Plan (1992) identifies the foothill bench area as critical for open space preservation, and establishes the Bonneville Bench as the boundary beyond which development is restricted. All lands on the foothill bench in Salt Lake City, both public and private, are currently designated as open space.

Within the Salt Lake City portion of the study area, the upper segments of Hell Canyon Trail and Jones Canyon Trail are located on land that is designated as open space. Likewise, the Bonneville Shoreline Trail is also located on bench land that is designated for open space use. It is recommended that this land use designation be maintained.

On the Beck Street level in Salt Lake City, the Warm Springs Fault Trail, Lime Canyon Cliff Trail, and lower portions of Hell Canyon Trail and Jones Canyon Trail should be designated as open space (see Figure 4). The corresponding trailheads for these trails and the Geological Park should also be designated as open space. Properties with trail segments located on the escarpment to the foothill bench should be open space, particularly since such steep slopes are not suitable for other types of development. Finally, the proposed clustering principle recommended for the business park is an important means for preserving, designating and integrating open space and trail corridors into the layout of future commercial and mixed uses developments envisioned for the area.



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SCALE IN FEET

SUMMARY OF ZONING ALTERNATIVES

PROJECT AREA

SALT LAKE CITY, UTAH

Dames & Moore

In the City of North Salt Lake, an opportunity exists for designating publicly-owned and undeveloped foothill land as open space. Publicly-owned property offers the best mechanism for preserving open space. Once property is in private ownership, the economic costs of public acquisition is far greater than retaining current public holdings. Large parcels of scenic and unusual land such as the Bonneville Bench are becoming increasingly rare, so the City of North Salt Lake should take this opportunity to provide a legacy for its residents.

Privately-owned land that is currently designated for residential use on the North Salt Lake bench should be encouraged for cluster residential development, leaving in place a community open-space network. The Unnamed Canyon Trail from Beck Street to the bench in the City of North Salt Lake would be partially developed on post-excavation property. The City of North Salt Lake has the opportunity to designate this land as open space in its Master Plan. This trail and the Bonneville Shoreline Trail, which passes through private property, could be accommodated by clustered residential development on the bench.

2.4.2 Strategy Two: Open Space Zoning

Although open space zoning will resist immediate development pressures, it is important to recognize that zoning is a reflection of municipal policy that may change in the future, and should not be relied upon to preserve open space for future generations. Zoning in the City of North Salt Lake and Salt Lake City should reflect the open space structure presented in Section 2.2.

Project-Area Application

All lands in Salt Lake City that are zoned open space should remain open space, with the exception of those areas affected by the recommended zoning changes described in Section 2.3.2. Trails, trailheads, and the geologic park should also have open space zoning.

The City of North Salt Lake should consider zoning lands currently in public ownership as open space to discourage development pressure on the south end of its bench. Zoning private lands as open space requires care to ensure that no takings occur. It is appropriate that properties currently excavating mineral aggregate in the City of North Salt Lake be zoned as open space when mining has ceased.

2.4.3 Strategy Three: Preserving the Bench from Mineral Extraction

Properties currently being excavated in Salt Lake City operate within an extractive industry roperties currently being excavated in City of North Salt Lake operate as conditional uses. Encouraging preservation of the bench from lawful extraction requires offering an incentive to the operators and property owners. Such incentives can evolve through negotiation and identifying economic trade-offs with the goal of no net loss of benefit to either the property owner with excavation rights or to the community with

lands zoned open space.

Project-Area Application

Reclamation standards will assist in preserving perimeter portions of the bench by identifying appropriate buffer zones within the extractive use property. These buffer zones are likely to differ in Salt Lake City and in the City of North Salt Lake according to the adjacent land use and site-specific physical and spatial conditions. According to the preferred land use scenario, land uses adjacent to extraction operations in Salt Lake City is open space. In the City of North Salt Lake the proposed land uses are primarily residential. A discussion of buffer zones is found in Section 2.6.6.

The designation of an aesthetic ridge line on the bench will be a factor in preserving open space on excavation property. Through negotiation and the identification of suitable economic trade-offs, the ridge line and bench above will be preserved in exchange for increased excavation in suitable areas below. A discussion of the recommended ridge line is found in Section 2.2.3.

The option to acquire critical parts of property currently being excavated remains a preservation mechanism for both cities. A discussion of this option follows in Section 2.4.4.

Both communities may put in place a voluntary program of Transferred Development Rights (TDRs) from the bench area on properties currently being excavated to other areas of the property or other properties in the study area. The transfer of development rights would be accompanied by development incentives for the property owner. A full discussion of TDRs is contained in Section 2.4.5.

2.4.4 Strategy Four: Acquisition of Property or Property Rights

The following types of acquisition have been considered as options for this project: *a) conservation easements, b) purchase of development rights* and *c) fee title.* It is suggested that both communities consider these as potential means for ensuring that trailhead access is secured before development takes place on the bench in the City of North Salt Lake, and prior to the redevelopment of Beck Street properties once excavation has ceased. The City of North Salt Lake and Salt Lake City should also consider these options as possible mechanisms for preserving portions of properties currently being excavated.

a) Conservation Easements

Conservation easements create a restriction on the use of a property in order to realize a conservation purpose for the general public. Conservation purposes can include the protection of natural, animal or plant habitats or ecosystems, protection of outdoor recreation or education areas, preservation of open space for scenic enjoyment, for meeting federal, state or local government conservation policies, or for conservation of

TRAILS AND TRAILHEADS
(approximate locations)
BECK STREET / FOOTHILL AREA PLAN

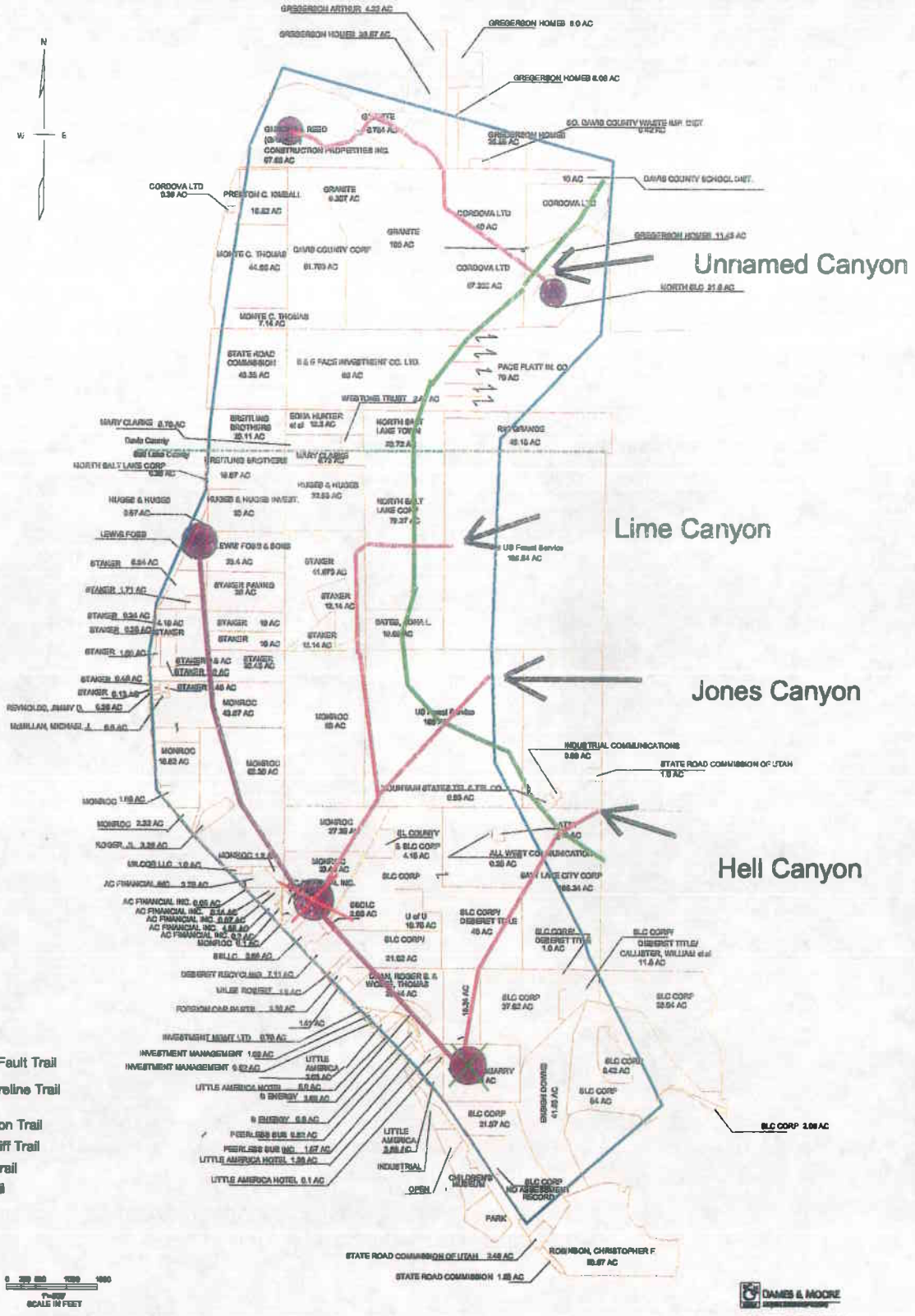

Figure 4

an historically important land area or certified historic structure.

Under the Internal Revenue Code, the donation of a conservation easement to a charitable organization or government entity may be tax-deductible. The easement must be protected in perpetuity. A conservation easement is not possible on property that retains rights to surface mining, or that extracts or removes minerals by a surfacing mining method, unless the probability of surface mining is so remote as to be negligible. [1]

The use of conservation easements and scenic easements has been largely facilitated by the formation of nonprofit land trusts such as Utah Open Lands Land Trust. Tax deductions often serve as a significant incentive for landowners to grant conservation easements to a nonprofit conservation organization. Under the federal income tax laws, a landowner may be eligible for a deduction where value has been transferred through the conveyance and the restrictions enable the donee to preserve the sensitive lands.

Conservation easements are essentially a donation of the development rights attached to a particular piece of land to a holding entity that will assure that those developments rights are never exercised. The economic value of a conservation easement is determined by valuing the development potential that is being eliminated, which is essentially the owner's profit anticipated upon the development of the land. The value of the conservation easement to the property owner is the fact that this "donation" can be taken as a deduction in calculating gross taxable income.

Project-Area Application

Conservation easements should be sought for all lands in public ownership in Salt Lake City and in the City of North Salt Lake to ensure that open space land uses remain open space in perpetuity. Negotiation with private property owners that have public trails designated through their property could include a conservation easement for trail access through the property. Conservation easements should also be sought for the portion of the Staker, Hughes and Hughes, and Monroc properties not zoned for extractive industry (EI) purposes.

b) Purchase of Development Rights

The City of North Salt Lake and Salt Lake City might both choose to purchase the development rights of land they wish to be retained as open space. This would have essentially the same impact as a conservation easement, except that at some point either city may decide to exercise the development right.

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[1] Internal Revenue Code, Research Institute of America Inc. 6/12/97, A170 Charitable, etc., contributions and gifts@.

Project-Area Application

Purchase of development rights may be an option for preserving critical pieces of excavation land in Salt Lake City or the City of North Salt Lake. The establishment of a trailhead on private lands in either city would require easement or property acquisition. Two trailheads in the City of North Salt Lake would provide access to the Bonneville Shoreline Trail and the bench. Three trailheads in Salt Lake City would provide access to the Warm Springs Fault Trail, the Geological Park and the Bonneville Shoreline Trail.

c) Fee Title to the Property

The cities may acquire the property itself in fee simple. Obviously, the primary obstacle to this is cost, unless the land is donated. As with conservation easements, a tax deduction could also be available where the land itself is donated or sold at a price which is below fair market value.

Project-Area Application

If fee title is considered, it may only be feasible in Salt Lake City where the land has an open space use, a corresponding open space fair market value and therefore, a more reasonable price. Acquisition costs may be much higher in the City of North Salt Lake on lands designated for residential use.

2.4.5 Strategy Five: Conservation Credits/Transferable Development Rights

In this scenario, either community could allow development rights to be transferred from one area (a "sending zone") to another area (a "receiving zone") without altering the net amount of development in an overall area or jurisdiction.

In brief, the development rights are severed from the "bundle" of property rights so that they can be traded in the market place. Purchasers of development rights receive a specified density increase on another property, which may be required to be located in a receiving zone, and sellers of the development rights get paid. The land from which the development rights are purchased is placed under restrictive covenants barring any development, or barring development in excess of the allowable zoning (if the program is mandatory).

Transferable Development Rights (TDR) is a mechanism to protect open space/sensitive lands by allowing development rights to be segregated from the land and transferred to a more suitable parcel of property. This concept should be distinguished from an intra-site density transfer. Under an intra-site density transfer, development rights are not separated from the property, rather, density may be transferred to less sensitive portions of a site. With TDRs, the development rights for a piece of property within a protected zone are segregated from that property. The development rights can either be transferred or sold to landowners in a development district or receiving zone. The property receiving the TDRs could then be developed at a higher density than normally allowed. To be

effective, TDRs must be capable of transferring value to other parcels of property so that the developer recognizes the market value of the TDR. In some TDR programs, no development is permitted on the Transfer Parcels and the transfer parcel must be legally protected as a conservation area either through donation or dedication. An alternative to a TDR program is an outright purchase of the development right. This approach is referred to as a Purchase Development Right (PDR). Basically, the PDR achieves the same result as a conservation easement.

The designation of a receiving zone must take into consideration the market value of the property and the maximum allowable density within the receiving zone. To be economically successful, developers should be able to recognize the value of TDRs by transferring the TDRs to the receiving zones.

It is also possible to have development rights become fully transferable. In this case the land owner would get additional development rights which could then be sold to another property owner. This possibility would probably be limited to rights which could be used in the receiving zone, or on specific properties.

Project-Area Application

Although the idea of Transferable Development Rights (TDRs) has been around for a number of years, many communities have found practical application difficult. For example, as of 1987 only 35 TDR programs were in place nationwide, with 14 specifically designed to preserve open space.[2] Less than half of the programs had been used at the time of the report, and most of those only minimally. It is often difficult to design a market-based compensatory scheme, which is essentially what a TDR program is, unless local jurisdictions are willing to establish a price.

In the Foothill/Beck Street area, a TDR program could be put in place with the foothill bench lands in Salt Lake City designated as the sending zone and the Beck Street elevation in Salt Lake City designated as a receiving zone. To encourage preservation of the bench that is currently zoned for extractive industries in Salt Lake City, a TDR could be developed which provides incentives for a property owner in the receiving zone (development incentives at the Beck Street Level or a steeper reclamation slope permitted to enable more mineral extraction) in exchange for restrictions in the sending zone (the foothill bench).

There could also be a TDR between properties on the bench in the City of North Salt Lake that are currently being excavated, and properties on the Beck Street level which are not actively excavating yet have the right to excavate in the future (the UDOT-owned property, for example).

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2 APA Planner's Advisory Service, *Transferrable Development Rights Programs,* 1987.

It has proven difficult to establish TDR programs in Utah in the past, but application of TDRs to the Extractive Industries zone in Salt Lake City is entirely plausible because it would be limited in scope. Once the extraction of gravel is completed, there is no guaranteed change of land use for the property. The master plan would provide for future use as a business park, but such future use should be held to a minimum density to allow for future trade-offs between full extraction to the agreed-upon ridgeline, and additional development rights for the reuse of the property. As extraction nears completion, the value of the future development rights to the property owner becomes greater, and there may be significant incentives to preserve additional bench lands for open space. It is critical that the master plan establish the distinction between the densities allowed with no TDRs and the maximum densities allowed with TDRs.

2.4.6 Strategy Six: Wetlands Designation

Salt Lake City and the City of North Salt Lake could ask the United States Army Corps of Engineers to perform an assessment and issue a determination as to the location and extent of wetlands in the study area. If wetlands are designated, any future impact on the wetlands would require a permit. Wetlands designation requires a substantial amount of environmental information which has not been collected, and it is not clear how much of the property at issue could potentially receive wetlands designation. A tentative estimate is that between one-half acre and one acre of potential wetlands are located on the bench near the county line.

One danger of not designating qualified wetlands is that if development occurs, and the land is later found to have been a wetlands area, the land will have to be restored. Restoration costs can be quite high, and the owner - *including a public entity* - would have to pay for it.

Project-Area Application

Both Salt Lake City and the City of North Salt Lake should consider contacting the U.S. Army Corp of Engineers to investigate the bench area to delineate existing wetlands.

2.4.7 Parcel-by-Parcel Summary of Strategies

The preceding discussion of open space and trail preservation strategies and their application in the project document the rationale behind each strategy. The property parcels in each community that are likely to be affected by the proposed open space and trail corridor preservation strategies are summarized in Appendix B.

The first priority for the City of North Salt Lake is to preserve bench properties that are publicly owned, and then those that are privately owned, utilizing the recommended strategies. Obtaining trailhead access would be the second priority in the City of North Salt Lake.

In Salt Lake City the first priority is to find ways to preserve bench lands currently being

excavated through the recommended mechanisms. Obtaining trailhead access would be the second priority.

2.5 SITE ENHANCEMENTS AND AESTHETICS

2.5.1 Site Enhancement and Art Elements

Numerous opportunities exist throughout the project area for site enhancements and the introduction of art elements. The following is a description of a proposed "toolbox" or "palette" approach through which specific embellishments can be gathered and implemented for the site. It is important to recognize that the natural site, combined with the effects left from years of mining, have intrinsic qualities of great beauty and history. Consequently, some restraint may be in order when proposing a site enhancement or when introducing art elements.

Restraint should be the rule regarding the introduction of enhancements in areas where existing view-sheds or other natural features such as watersheds, wetlands, rock outcrops, vegetation or habitat would be qualitatively diminished. In areas surrounding the Cliff Face Trail, Bonneville Shoreline Trail, the historic Lime Kiln and adjacent bowls, basin, valleys, swales and gullies, few, if any, introductions should be permitted. Exceptions might include the introduction of sign elements embedded in the ground plane, such as those currently in place in the City Creek Park sidewalks.

There are several existing opportunities for site enhancements that should be taken advantage of. For example, consideration should be given to linking the entire site from north to south, east to west, and integrating it vertically through canyon access points. Linkages can occur in the form of pathways and trails, or through visual means such as view-shed orientation, seating alignments, and the location of cairns or waterways.

Moving north from the recently completed Warm Springs Park, those areas with the best potential for site enhancements and the introduction of art elements are as follows:

a. *Warm Springs Fault Trail*
b. *Hell Canyon Park*
c. *Jones Canyon*
d. *Lime Canyon*
e. *Cliff Face Trail*
f. *Un-named Canyon Trail*
g. *Remnant Natural Area ("Green Thumb" or "UDOT Site")*
h. *Bonneville and Provo Benches*

The toolbox or palette to be utilized when implementing site enhancements or art elements should include the following ideas and conceptual points of departure:

a. *Signage:* Altitude markers, directional signage, and points of interest.

b. *Seating:* Appropriately designed and placed for rest areas and view points. The placement of benches and other types of seating elements should be focused where possible.

c. *Lighting:* Lighting should be avoided except where necessary for safety reasons.

d. *Historic Markers:* Markers should be treated as signage, and the construction of freestanding monuments should be avoided. Signs and markers should be designed and built in a cohesive, integrated manner.

e. *Timelines:* Historical and geological markers, including descriptive timelines, may be created in paving areas and gathering points as appropriate.

f. *View Markers:* Descriptive markers and viewing devices such as telescopes and site lines may be added to inform and enhance the view of such features as the Great Salt Lake islands, migratory areas, Ensign Peak and the Pony Express Trail.

g. *Bridges:* Canyon access points may be discreetly bridged to provide safe, accessible gateways to and from the Benches and symbolically tie disturbed landscape forms back together.

h. *Watern Elements:* Numerous opportunities exist to tap or re-route waterways and springs, provided that such modifications do not diminish habitat or wetlands, or increase erosion. Introduced water features should be avoided on the Bonneville Shoreline Trail and within the Bonneville and Provo Bench viewsheds, with the exception of drinking fountains.

i. *Cliff Face:.* Steep slope faces should be finished in a craftsman-like manner. A uniform face should be cut to reveal the underlying geology, and where necessary "Green Sutures" may be established (see below).

j. *Green Sutures:* At certain points, such as where deep or irregular mining scars diminish the appearance of the cliff face, the establishment of new vegetation should be considered as a symbolic, healing and stabilizing element.

k. *Habitat Markers &Text:* The inclusion of informational markers is encouraged, especially at

the boundaries between ecological communities.

l. Wetland-cycle Works: The wetland above Lime Canyon on the Bonneville Bench should be carefully marked and protected. Interpretive markers could be included that note the vegetative and ecological significance of the wetland.

m. Remnant Piece of Nature: An opportunity exists at the UDOT Site for the inclusion of an art element in the form of a Hard Edge Frame and a Feathered Ecotone. A Hard Edge Frame would exist as a fence, gate, border or other defined edge treatment, and would be most applicable near the front and rear edges of the "Green Thumb". A Feathered Ecotone could use vegetation and other natural materials as a softer "wall", which would be most appropriate near the border with the cliff face to the south.

2.5.2 Beck Street Gateway Identification and Aesthetic Treatment

The aesthetic and visual enhancement of Beck Street and its surrounding environment is an important component of this plan. Beck Street is a significant roadway that is expected to become more relevant as years pass. Not only is the street a major traffic and transportation route, but it is also a major gateway for Salt Lake City and the City of North Salt Lake.

At present Beck Street is a harsh and forbidding zone. The street is wide, the traffic heavy, and surrounding land uses are industrial and austere in nature. The roadway consists of three lanes in each direction which move traffic efficiently, if not particularly safely, through the area. Human-scale elements such as sidewalks and lighting are conspicuously absent from the road edge, while the high speed and heavy traffic level has resulted in severe air, noise, traffic and safety problems.

General Streetscape, Gateway and Aesthetic Principles

As illustrated in Figures 5 and 6, a phased approach is proposed to improve Beck Street and the surrounding environment. *Short-term improvements* focus on clean-up, screening and beautification of the roadway. *Long-term programs* focus on major renovations and land use transformations. Regardless of the implementation period, all future efforts should lead toward a long-term aesthetic and functional vision for the area.

Short-term (0-10 years) Gateway Identification and Aesthetic Treatment

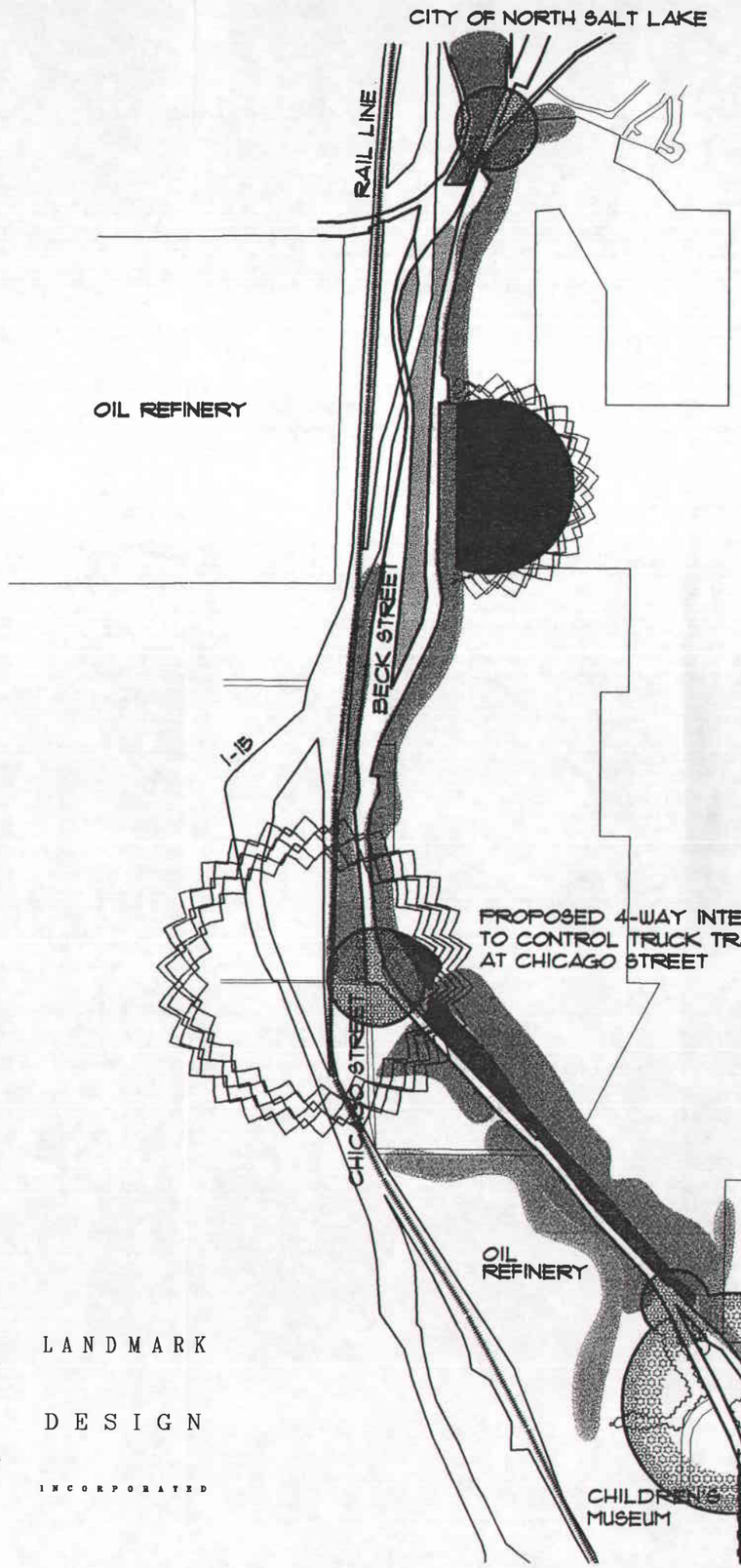
The short-term focus is on minor improvements within and immediately adjacent to the Beck Street right-of-way. As illustrated in Figure 5, these improvements include screening unsightly uses, improving business entry zones, commencing the development

of a "greenway" on the east side of Beck Street, and initiating the development of gateway nodes on the north and south ends of the corridor. Other important short-term improvements include differentiating Beck Street from nearby Interstate 15 through environmental art elements, developing a major entry node at Chicago Street, and preserving the "UDOT Site" as a "Green Thumb" remnant of the original mountainside. The short-term intent is to beautify the street, block offensive views and jump-start the processes that lead to long-term improvement goals. Specific short-term actions include the formalization of parking and entrances to adjacent uses, implementation of a cycle commuter route between Salt Lake City and communities to the north, implementation of screening to block views of adjacent oil refineries and extraction industries, and the introduction of basic pedestrian facilities such as sidewalks, street lights, bus stops, trees and street-related infrastructure.

As illustrated in Figures 7 and 8, a number of possible treatments are available to help meet these objectives. For example, walls, fences and berms can be developed to veil offensive land uses along the roadway. Trees and plant materials will help soften the streetscape and cleanse the dusty, dry air. Walkways, lighting and signs will help to improve human-scale qualities of the street. A detailed Design and Development plan will be necessary to maximize the effect of the short-term improvements, and to establish common goals for public and private improvement projects.

Long-term (10-50+ years) Gateway Identification and Aesthetic Treatment

The long-term focus is on major improvements within the greater Beck Street district. Long-term actions should build upon and strengthen short-term efforts while meeting long-term improvement goals (see Figure 6.) As the general character of the area evolves from an industrial precinct into a mixed-use business zone, major open space improvements should be initiated within the street right-of-way and along the street edge. It is assumed that Beck Street will be transformed into a major boulevard and entrance zone for both Salt Lake City and the City of North Salt Lake. The main long-term features include an extensively redesigned and softened streetscape composed of trees, vegetation, pedestrian amenities and lighting. A wide parkway/green belt is envisioned on the eastern length of the street, serving as a forecourt to a major business park. The Greenway should merge with the business park, which should be developed with generous amounts of open space and parkland. A Class One bike path should replace the utilitarian commuter bike route, and enhanced pedestrian facilities should be introduced along the eastern edge of the street. Warm Springs Fault Trail and Lime Canyon Cliff Face Trail should be developed to provide a continuous trail experience along Beck Street, and embellished with trailheads leading to the Bonneville Shoreline Trail on the bench. Existing business entrances should be improved through enhanced landscaping and the implementation of a reverse parking-to-building relationship, where buildings are placed adjacent to the street and parking lots are in the rear. Not only will this help create a cleaner and easier to read street image, it will also improve vehicular circulation and bring the scale of the street down to human proportions. The business park should be



SHORT-TERM CONCEPT

(0-10 YEARS)

SCREENED EDGE
IMPROVE VISUAL IMAGE OF GATEWAY STREET WHILE EMPHASIZING BOULEVARD CHARACTER AND SENSE OF ENCLOSURE

POSSIBLE TREATMENTS: 1, 2, 8-10, A-E (SEE FIGURE 8)

BUSINESS ENTRY ZONE
ENHANCE ACCESS TO BUSINESSES, IMPROVE PARKING AND LOADING, ENHANCE IDENTITY

POSSIBLE TREATMENTS: 2, 3, 4, 6, 8-10, A-E (SEE FIGURE 8)

EASTSIDE GREENWAY
IMPROVE VISUAL QUALITY, EMPHASIZE ENTRY, REDUCE SCALE AND ENHANCE BOULEVARD CHARACTER

POSSIBLE TREATMENTS: 5, A, D (SEE FIGURE 8)

I-15 FREEWAY INTERFACE ZONE
SPECIAL TREATMENT TO DIFFERENTIATE BECK STREET FROM ADJACENT FREEWAY AND THE PHYSICALLY SEPARATED PORTION OF NORTHBOUND AND SOUTHBOUND BECK STREET LANES

POSSIBLE TREATMENTS: 1-4, 7-10, (SEE FIGURE 8) SPECIAL ENVIRONMENTAL ART ELEMENTS

CITY ENTRY ZONES
SPECIAL TREAMENTS TO ENHANCE GATEWAY FEELING FOR SALT LAKE CITY AND NORTH SALT LAKE CITY ENTRANCES

POSSIBLE TREATMENTS: 2-10, A-E, (SEE FIGURE 8) SPECIAL ARCHITECTURAL ELEMENTS, PARK DEVELOPMENTS, BUSINESS DEVELOPMENTS

I-15 NORTH GATEWAY
IMPROVE IDENTIFIED GATEWAY ACCORDING TO SLC OPEN SPACE PLAN AND TRANSPORTATION GOALS, LINK BECK STREET WITH LANDSCAPE IMPROVEMENTS TO WEST

POSSIBLE TREATEMENTS: 3, 4, 6, 8-10, A-E, (SEE FIGURE 8) SPECIAL ARCHITECTURAL ELEMENTS

GREEN 'THUMB'
IN THE SHORT-TERM, PRESERVE EXISTING OPEN SPACE AND ENHANCE WITH ADDITIONAL VEGETATION AS A GREEN BUFFER TO SURROUNDING GRAVEL OPRATIONS

NORTH

SCALE: 1"=2000'

LANDMARK DESIGN INCORPORATED

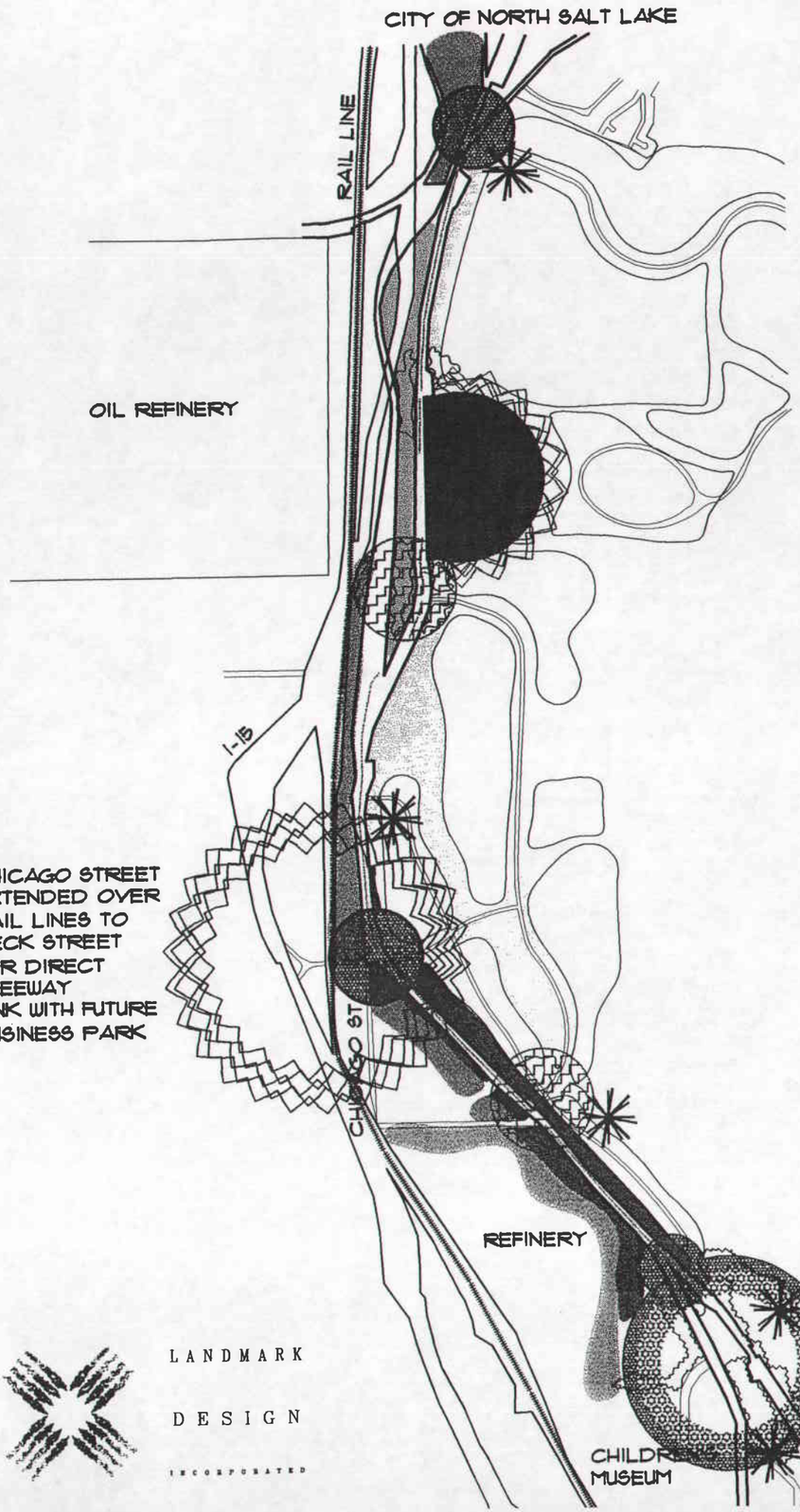
BECK STREET RECLAMATION FRAMEWORK AND FOOTHILL AREA PLAN

BECK STREET GATEWAY IDENTIFICATION AND AESTHETIC TREATMENT

FIGURE 5

BECK STREET RECLAMATION FRAMEWORK AND FOOTHILL AREA PLAN

BECK STREET GATEWAY INDENTIFICATION AND AESTHETIC TREATMENT



LONG-TERM CONCEPT

(10-50+ YEARS)

SEMI-OPEN SPACE
PROVIDE A CONTINUOUS LANDSCAPED PARKWAY AT BECK STREET EDGE THAT CREATES A STONG BOULEVARD CHARACTER WHILE PERMITING VIEWS THROUGH TO ADJACENT LAND USES

POSSIBLE TREATMENTS: 4, 6, 7-10, A-E (SEE FIGURE 8)

SCREENED EDGE
IMPROVE VISUAL IMAGE OF GATEWAY STREET WHILE EMPHASIZING BOULEVARD CHARACTER AND SENSE OF ENCLOSURE

POSSIBLE TREATMENTS: 1, 2, 3, 8-10, A-E (SEE FIGURE 8)

BUSINESS ENTRY ZONE
ENHANCE ACCESS TO BUSINESSES, IMPROVE PARKING AND LOADING, ENHANCE IDENTITY

POSSIBLE TREATMENTS: 2, 4-6, 8-10, A-E (SEE FIGURE 8)

LANDSCAPED MEDIAN STRIP OR EASTSIDE GREENWAY
IMPROVE VISUAL QUALITY, EMPHASIZE ENTRY, REDUCE SCALE AND ENHANCE BOULEVARD CHARACTER

POSSIBLE TREATMENTS: 5, 6, 8-10, A, D (SEE FIGURE 8)

I-15 FREEWAY INTERFACE ZONE
SPECIAL TREATMENT TO DIFFERENTIATE BECK STREET FROM ADJACENT FREEWAY. SYMBOLICALLY CONNECT THE DIVIDED NORTHBOUND AND SOUTHBOUND BECK STREET LANES

POSSIBLE TREATMENTS: 1-4, 7-10, (SEE FIGURE 8) SPECIAL ENVIRONMENTAL ART ELEMENTS

CITY ENTRY ZONES
SPECIAL TREAMENTS TO ENHANCE GATEWAY FEELING FOR SALT LAKE CITY AND NORTH SALT LAKE CITY ENTRANCES

POSSIBLE TREATMENTS: 2-10, A-E, (SEE FIGURE 8) SPECIAL ARCHITECTURAL ELEMENTS, PARK AND BUSINESS DEVELOPMENTS

I-15 NORTH GATEWAY
IMPROVE IDENTIFIED GATEWAY ACCORDING TO SLC OPEN SPACE PLAN AND TRANSPORTATION GOALS, ENHANCE LINKAGE OF BECK STREET WITH LANDSCAPE IMPROVEMENTS TO WEST

POSSIBLE TREATEMENTS: 3, 4, 8-10, A-E, (SEE FIGURE 8) SPECIAL ARCHITECTURAL ELEMENTS

GREEN 'THUMB'
IN THE LONG-TERM, ENHANCE PRESERVED OPEN SPACE WITH ADDITIONAL VEGETATION AS A GREEN REMNANT OF THE EXCAVATED HILLSIDE. DEVELOP AS PARKLAND

POSSIBLE TREATMENTS: ENHANCE WITH ADDITIONAL VEGETATION AND PARK AMMENITIES

MINOR ENTRY ZONES
SPECIAL TREATMENTS TO ENHANCE BECK STREET ENTRANCES TO BUSINESS PARK

POSSIBLE TREATMENTS: 2-10, A-E, SPECIAL ARCHITECTURAL AND OPEN SPACE TREATMENTS

PEDESTRIAN NODE OR TRAILHEAD

NORTH

SCALE: 1"=1000'

LANDMARK DESIGN INCORPORATED

FIGURE 6

BECK STREET RECLAMATION FRAMEWORK AND FOOTHILL AREA PLAN

BECK STREET GATEWAY INDENTIFICATION AND AESTHETIC TREATMENT

SHORT AND LONG TERM PROPOSALS
TYPICAL SECTIONS - LOOKING NORTH

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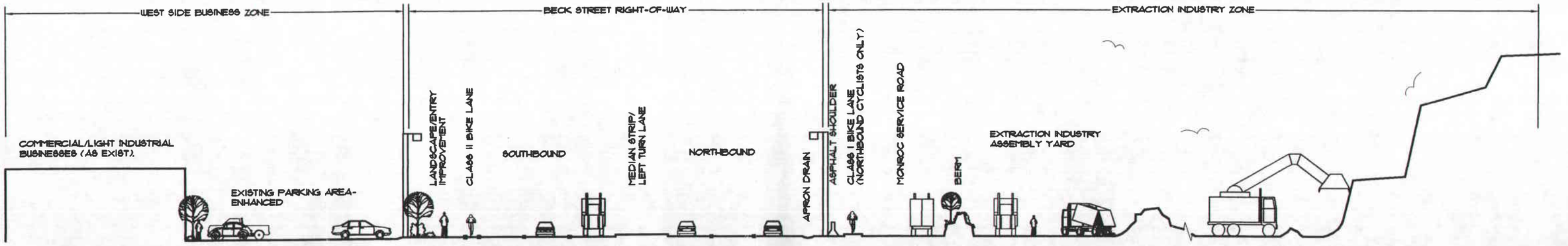
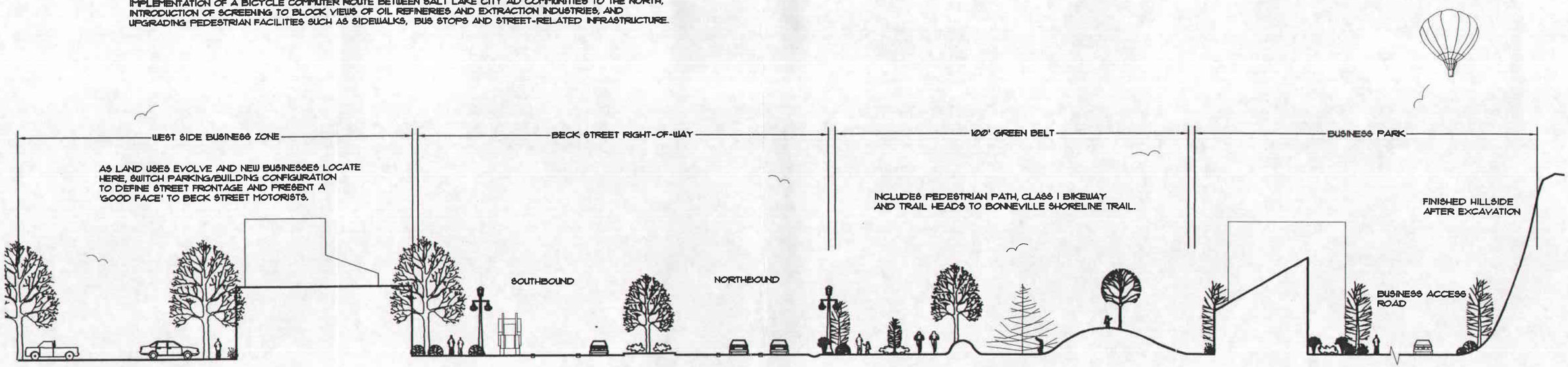


SHORT-TERM PROPOSAL (0-10 YEARS)

FOCUS ON MINOR IMPROVEMENTS WITHIN AND IMMEDIATELY ADJACENT TO THE BECK STREET RIGHT-OF-WAY. THE INTENT IS TO BEAUTIFY THE STREET AND BLOCK THE VIEW OF OFFENSIVE ADJACENT USES.

MAIN FEATURES INCLUDE THE FORMALIZATION OF PARKING AND ENTRANCES TO ADJACENT OPERATIONS, IMPLEMENTATION OF A BICYCLE COMMUTER ROUTE BETWEEN SALT LAKE CITY AD COMMUNITIES TO THE NORTH, INTRODUCTION OF SCREENING TO BLOCK VIEWS OF OIL REFINERIES AND EXTRACTION INDUSTRIES, AND UPGRADING PEDESTRIAN FACILITIES SUCH AS SIDEWALKS, BUS STOPS AND STREET-RELATED INFRASTRUCTURE.



LONG-TERM PROPOSAL (10-50 YEARS)

FOCUS ON MAJOR IMPROVEMENTS AS LAND USES CHANGE AROUND BECK STREET. IT IS ASSUMED THAT BECK STREET WILL BE TRANSFORMED INTO A MAJOR BOULEVARD AND ENTRANCE/GATEWAY ZONE FOR BOTH COMMUNITIES.

MAIN FEATURES INCLUDE AN EXTENSIVELY REDESIGNED AND SOFTENED STREETSCAPE INCLUDING TREES, VEGETATION AND LIGHTING. A WIDE PARKWAY/GREEN BELT IS ENVISIONED ALONG THE ENTIRE EASTERN LENGTH OF THE STREET, SERVING AS A FORECOURT TO A MAJOR BUSINESS PARK. THE BUSINESS PARK SHOULD BE DESIGNED IN CAMPUS-FASHION WITH OPEN SPACE AND PARKLAND GENEROUSLY INTEGRATED INTO THE LAYOUT. A CLASS ONE BIKE PATH AD ENHANCED PEDESTRIAN FACILITIES ARE ENVISIONED, AS ARE EMBELLISHMENTS SUCH AS A TRAIL ALONG THE LIME CANYON CLIFF FACE AND ENVIRONMENTAL ART ALONG I-15.

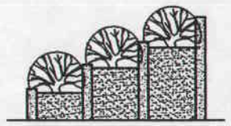
FIGURE 7

BECK STREET GATEWAY IDENTIFICATION AND AESTHETIC TREATMENT

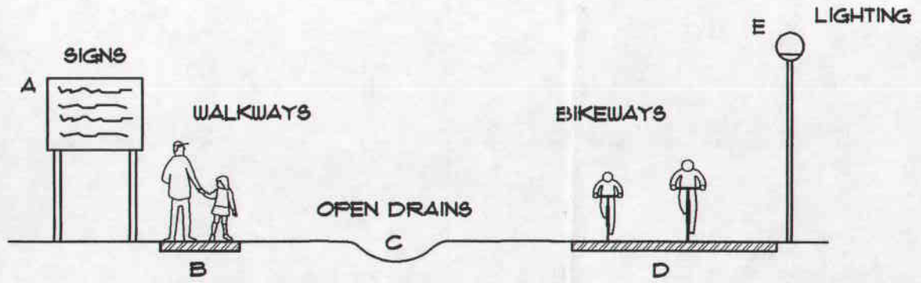
POSSIBLE TREATMENTS

1 FENCE
LESS THAN 1'

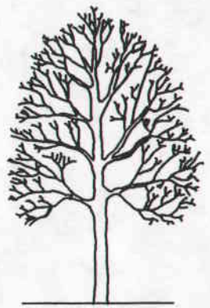
2 WALL
1 TO 3'



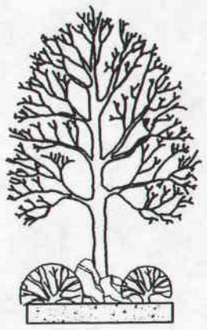
3 PLANTED WALL
8' TO 12'



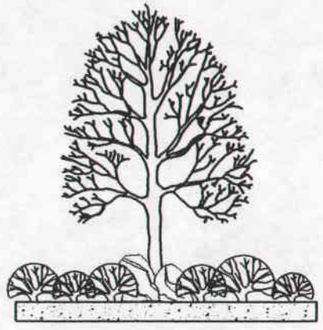
PEDESTRIAN ELEMENTS



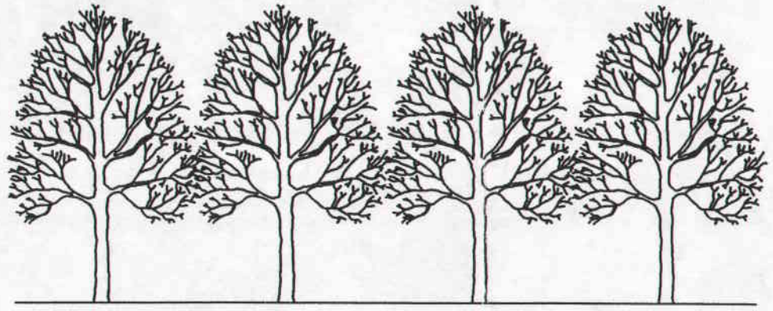
4 SINGLE TREE
8' TO 12'



5 MEDIAN STRIP
8' TO 12'

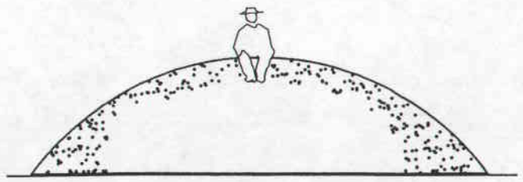


6 SINGLE TREE WITH
UNDERSTORY PLANTING
15' TO 20'

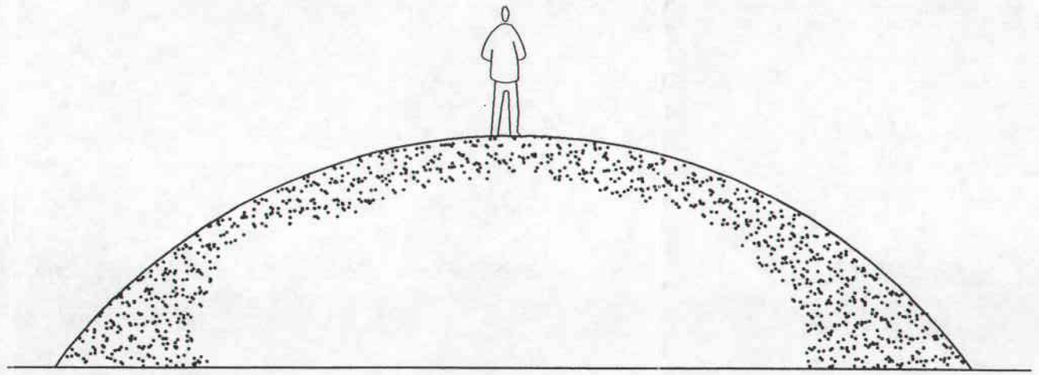


MULTI-ROW TREE
7 ALLEE OR STREETSIDE PARK
30' TO 60'

8 SMALL BERM
8' TO 12'



9 MEDIUM BERM
15' TO 30'



10 LARGE BERM
30' TO 60'

LANDMARK
DESIGN

FIGURE 8

built as a planned unit development, with no direct vehicular access onto Beck Street. Other important concepts include connecting the business park to Interstate 15 via a bridged fly-over, developing trailheads at Hell Canyon Park and the new northern access road, and integrating the UDOT "green thumb" with adjacent post-excavation open spaces.

The long-term intent is to renovate Beck Street and the surrounding environment as a major gateway district, beautiful boulevard and distinct neighborhood. After the face-lift, Beck Street should be capable of attracting a wide mix of business and commercial activities. Offensive views of adjacent uses should continue to be screened, although the focus should be shifted to the development of a positive streetscape. Specific activities include completion of the Interstate15 interface zone and realization of city entry zones at the southern and northern extremes of the roadway. Pedestrian facilities should be developed that befit a major boulevard, including wide sidewalks, a Class One bike path, parks, parkways, landscaped median strips and other enhanced street-related infrastructure.

The possible treatments illustrated in Figures 7 and 8 apply in the long-term, although the scale and level of input should be more grand. A detailed Design and Development plan will be necessary to maximize the effect of the long-term improvements and to establish common goals for public and private improvement projects.

2.6 STANDARDS FOR THE INDUSTRY

This section addresses the environmental and aesthetic consequences of on-going extraction operations that are in close proximity to downtown Salt Lake City and a growing residential precinct in the City of North Salt Lake. It also addresses the finished state of excavation properties once mining has ceased.

Standards for ongoing excavation include identification of existing environmental regulations that govern the impacts associated with or potentially associated with gravel mining. These include noise, air pollution and dust, vibrations from blasting and equipment, soil and water pollution and visual nuisances. The plan lists responsible agencies with vested powers to address community complaints, and the buffers on excavation property which can be applied depending on the adjacent land use and the performance of excavation practices.

Additional buffering techniques that may be appropriate are also addressed. These include altering land forms; constructing physical barriers such as berms fences or walls; planting new vegetation; and modifying excavation methods, production intensity, hours of operation or the location of production activities. Standards for post-excavation are also included, addressing erosion risks, slope stability, safety and visual disturbances associated with the interface between reclaimed mining areas and other nearby uses.

The air, noise, vibration, land and water impacts of sand and gravel excavation and processing operations are discussed below. Mitigation strategies are recommended where applicable. A minimum buffer distance between the gravel pits and residences has not been established because it is dependent on the media impacted (air, noise and vibrations, for example), the specific situation (e.g., if a line of sight exists from the operation to the proposed development for noise impacts), and the mitigation strategy that the operator proposes to undertake. Instead of establishing a minimum buffer distance, guidelines have been recommended for each impact that the cities can refer to while negotiating mitigation strategies between a gravel pit operator and a developer who plans to develop a subdivision in the vicinity of a gravel pit.

TABLE 1
National Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS, µg/m3
PM10	24-hour Annual	150 50
Nitrogen dioxide	Annual	100
Sulfur dioxide	3-hour 24-hour Annual	1,300 365 80
Carbon Monoxide	1-hour 8-hour	40,000 10,000

2.6.1 Air Impacts

Ambient Air Quality Near the Study Area

Each county in the State of Utah is divided into attainment and non-attainment areas for the criteria pollutant (particulate matter, nitrogen oxides, sulfur dioxide, carbon monoxide, ozone, and lead). Attainment areas are areas that meet the National Ambient Air Quality Standards (NAAQS) for each criteria pollutant while non-attainment areas do not meet the NAAQS for one or more criteria pollutants. The Utah Division of Air Quality (UDAQ) maintains an ambient air quality monitoring station near the study area. The data from the ambient air quality monitoring station West of Beck Street across from Staker Paving and other such stations in Salt Lake County have been used to classify the county as a non-attainment area for PM10 (particulate matter less than 10 microns in diameter) and ozone. Salt Lake City is also a non-attainment area for carbon monoxide. The NAAQS for the criteria pollutants are presented in Table 1.

Pollutants Emitted from Gravel Mining Operations

Air pollutants at gravel pits are emitted as particulate matter from the following sources:

a. *Wind erosion of open areas*
b. *Wing erosion of storage piles*
c. *Crushing*
d. *Screening*
e. *Drop points*
f. *Haul trucks*
g. *Drilling and blasting*

Off-road mobile sources such as loaders, dozers, scrapers and trucks operating at the pit primarily emit nitrogen oxides and carbon monoxide. Air pollutants can also be emitted from the operation of asphalt plants and concrete batch plants. Asphalt plants can emit nitrogen oxides, sulfur dioxide, particulate matter, carbon monoxide, and volatile organic compounds. Concrete batch plants primarily emit particulate matter. The pollutants may cause respiratory problems and other illnesses, which are well researched and documented.

USAQ Permitting and Compliance Processes

All sources of air pollution (excluding some insignificant sources) are required to obtain an Approval Order from UDAQ. In order to obtain an approval order from the UDAQ, a company must list the various sources of air pollution at the plant, quantify the emissions from each emission unit, satisfy Best Available Control Technology Requirements (BACT) for emissions from all emission units in the plant, and follow appropriate monitoring, record keeping, and reporting requirements. Each gravel pit in the Beck Street corridor has an Approval Order that lists conditions specific to the operation at the pit. Compliance inspections are performed according to a schedule established by the UDAQ and also when residents call the UDAQ and complain about excessive dust, odor, etc. from specific operations. The operators may be assessed penalties if the UDAQ compliance inspectors find the operation to be in violation of the conditions of the Approval Order.

Mitigating Emissions from Gravel Pits

Best Available Control Technology (BACT) requirements suggest that particulate matter emission from gravel pits be mitigated mainly by using wet suppression. Wet suppression consists of spraying all haul roads with water and/or chemical dust suppressants, using spray bars at drop points to wet the aggregate being processed and wetting down of open areas. If adequate water is used, the efficiencies could be between 70 to 90 percent. Asphalt plants use baghouses or wet scrubbers to mitigate air emissions. The efficiencies of baghouses could exceed 99 percent while the efficiencies of scrubbers could exceed 95 percent.

Responding to Emergency Episodes

The various sources of air pollution including the gravel pit operators on Beck Street are required to submit Alert, Warning, and Emergency episodes plans to the UDAQ. These

plans are triggered by the UDAQ based on increasing concentrations of the criteria pollutants as measure by the nearest ambient air quality monitor. The Alert level is the level at which first stage control action is to begin. The warning level indicates that air quality is continuing to degrade and that additional control actions are necessary. The emergency level indicates that air quality is continuing to degrade toward a level of significant harm to the health of persons and that the most stringent control actions are necessary. When an Alert, Warning, or Emergency level is called by the UDAQ, each affected source of air pollution needs to implement the necessary action based on the source-specific plan approved by the UDAQ. Examples for actions to be adopted at the three levels of controls could include watering in addition to the amount required to be used on other days (Alert level), shutting down some units (Warning level), or shutting down the entire operation (Emergency level). These measures are rarely called for by the UDAQ but are probable during periods of prolonged atmospheric inversion when the pollutants are stagnated near the surface. The above process protects the public against breathing excessively high levels of pollutants.

Recommendations

The application of Best Available Control Technology as required by UDAQ, the above response to emergency episodes, and the UDAQ permitting and compliance process demonstrates that UDAQ has a mechanism in place to minimize emissions of pollutants from gravel pits. The gravel pits are required to control emissions as required in the UDAQ permit and operate in an environmentally responsible manner. It is possible that during a few stormy days each year, a significant amount of particulates are emitted from the gravel pits that might affect present or future development in the vicinity of the gravel pits, but this is incidental to the nature of the gravel mining operations. Proper planning and reclamation of the pits should eventually minimize the amount of fugitive particulate emissions during such storm events.

2.6.2 Noise Impacts

The human ear responds to a wide range of sound intensities. The decibel (dB) scale used to describe sound intensity is a logarithmic scale that accounts for the wide range of audible sound intensities and the human perception of loudness. For example, an increase in 10 decibels is perceived by humans as doubling loudness. A 70 decibel sound level will appear twice as loud as a 60 decibel sound level. People cannot generally detect differences of 1 dB, and under ideal laboratory situations, differences of 2 or 3 decibels can be detected. A five decibel change would be expected to be perceived under normal listening conditions. During quieter periods, such as during night-time hours or rural settings, changes in sounds appear more perceptible, which is not caused by louder sound but by decreased background sound levels. This is usually reflected in noise ordinances where different land use zones and times of the day have different noise limits.

When addressing the effects of noise on people it is also necessary to consider the

frequency of response of the human ear. Sound level instruments are therefore designed to respond or ignore certain frequencies. The frequency weighting most often used is the AA-weighted decibel@ or dBA. Sound levels in this evaluation are based on the A-weighted decibel scale.

Noise Ordinance

All excavation operations in the Salt Lake City portion of the study area must conform to the Salt Lake County Noise Ordinance (Section 9.0-Use District Noise Levels, Health Regulations, #21-Noise Control, August 1,1991). Excavation operations in the City of North Salt Lake should comply with Davis County noise legislation.

As an example of typical noise legislation, the Salt Lake County Noise Ordinance (Section 9.0-Use District Noise Levels, Health Regulations, #21-Noise Control, August 1,1991) is presented below:

Maximum Permissible Sound Levels

(a) It shall be a violation of these rules and regulations for any person to operate or permit the operation of any stationary noise source of sound creating a ninetieth percentile sound pressure level (L90) for any measurement period (not less than 10 minutes unless otherwise provided in these regulations) that exceeds the limits set forth for the following receiving land use districts when measured at the boundary or any point within the property affected by the noise.

Zone	Night (10:00 PM - 7:00 AM)	Day (7:00 AM - 10:00 PM)
Residential/Agricultural	*50 dBA*	*55 dBA*
Commercial	*55 dBA*	*60 dBA*
Industrial	*75 dBA*	*80 dBA*

(b) When a noise source can be identified and measured in more than one land use category, the limits of the most restrictive use shall apply at the boundaries between different land use categories.

Noise Impacts from Gravel Mining Operations

Noise impacts can result from several sources in a gravel mining operation. There are stationary and mobile sources of noise. Stationary sources of noise include crushing, screening and asphalt plant drum operation, for example. Typical mobile sources of noise include truck, scraper, loader and grader operation. Drilling and blasting operations can also result in noise impacts.

A heavy truck or a pneumatic drill can produce noise levels of 85 to 90 dBA when measured at the distance of 50 feet from the source. If a heavy truck passes a residence, the ninetieth percentile sound level averaged over a period of 10 minutes will be less than

90 dBA, which is much higher than the sound levels established by the Salt Lake County ordinance reproduced above. Such a situation will need mitigation of the noise impacts by the operator to conform to the appropriate noise ordinance. In this instance, the excavation operator and developer need to communicate with each other before the residential development is constructed or occupied in order to convince the City or County that appropriate mitigation noise measures will be in place.

Mitigation and Recommendations

Noise impact levels from operations are highest when there is a direct line of sight between the observer (or residence) and the source (e.g. a crushing operation). Mitigation measures depend on the distance of the operation from the adjacent use (present or proposed) and several other factors including the nature and intensity of the operation, unmitigated sound levels and nature of the terrain. Noise impacts are usually mitigated by barriers, including noise walls or berms. The length, thickness, and the height of the barrier should be decided on a case-by-case basis by performing actual monitoring using a Type II Sound Level Meter that conforms to the American National Standards Institute (ANSI) Specification for Sound Level Meters (ANSI S1.4-1971).

It is recommended that actual monitoring on a case-by-case basis will be more effective and justifiable than imposing a minimum buffer distance. Any further changes to the operation proposed by the operator that my significantly affect the noise levels at the nearest residence has to be communicated to the city or county government and appropriate mitigation measure have to be undertaken to comply with the noise ordinance.

2.6.3 Vibrations

Sand and gravel pits in the Beck Street area may operate near areas of present and/or future residential development. As part of the day-to-day operations of the pits, vibration levels should be a primary concern. This is particularly true for operations which take place near residential developments or smaller commercial buildings.

Vibrations produced during construction operations are important primarily because of the potential to cause complaints or damage to a variety of structures. Frequently, complaints are from homeowners claiming damage to interior walls or exterior walls and foundations, or both. The intent is to provide guidelines to reduce the effects of vibrations generated from the pit operations on both residential structures and the disturbing effects perceived by homeowners.

Construction vibrations are generally of three different types: *1) transient or impact, 2) steady-state or continuous,* and *3) pseudo steady-state.* Examples of transient vibrations include blasting, impact pile driving and wrecking balls. Steady-state vibrations may be generated by vibratory pile drivers, pumps and compressors. Pseudo steady-state vibrations are generally more random, such as jack hammers, trucks, bulldozers, scrapers

and cranes. The vibrations generated during pit operations are expected to be primarily of the pseudo-steady-state variety, as caused by haul trucks, dozers, backhoes and scrapers. It is further anticipated that transient vibrations due to blasting will also be generated on a periodic basis.

Typical vibration intensities are illustrated in Figure 9. The data was obtained from field measurement during construction operations *(Wiss, 1974)*. The data is approximate and illustrates the relative vibration intensities from a variety of sources. Since soil conditions and topography can have significant effects on the intensity of vibrations, it is recommended that an instrumentation and monitoring program be implemented. A monitoring program will provide actual data concerning vibration levels, rather than impressions or perceptions.

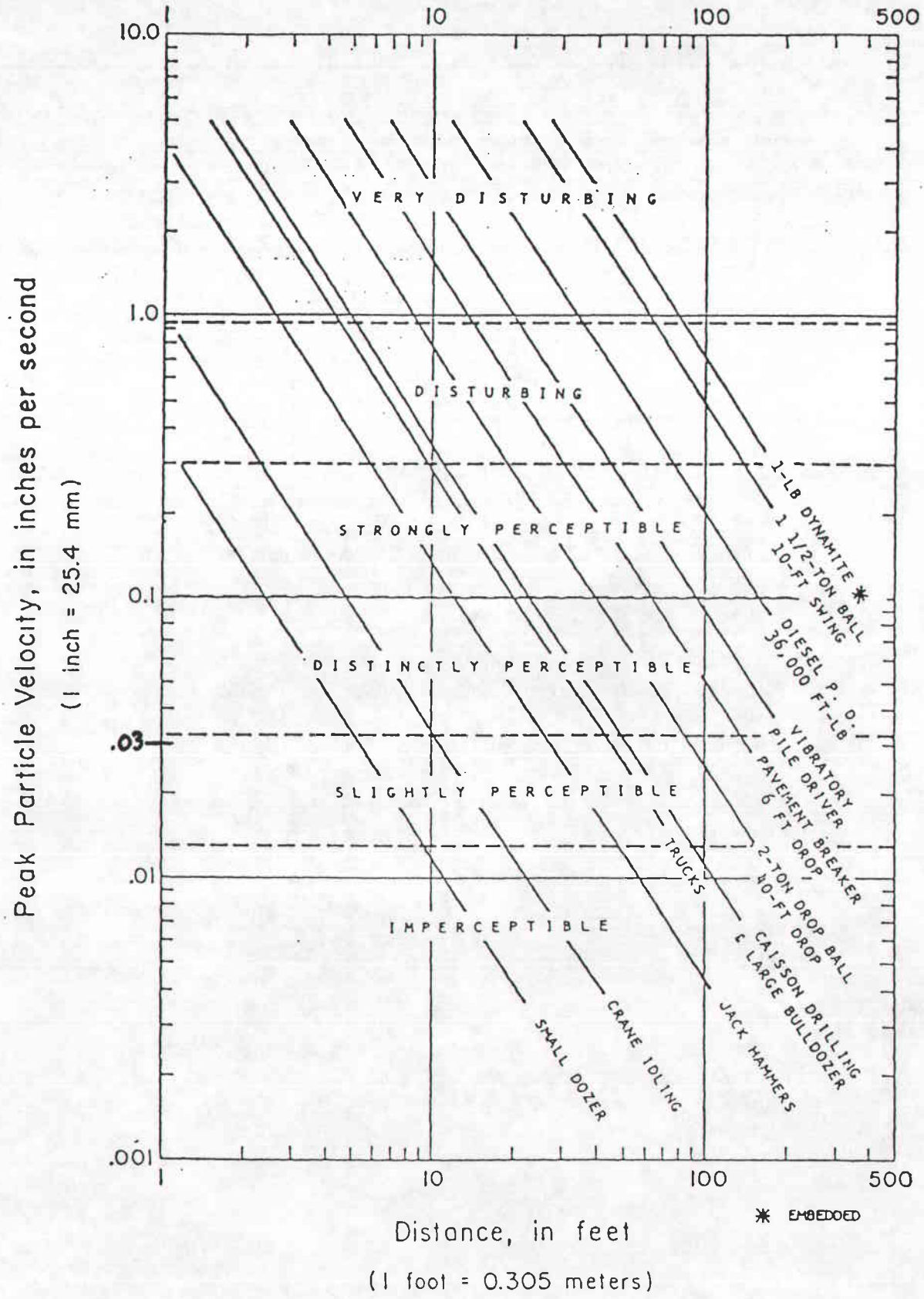
Based on the work of a number of researchers, criteria have been developed to limit vibrations which would cause structural damage to residential or small commercial buildings (USBM, 1971; Edwards and Northwood, 1960; Chae, 1978; Langefors, et al, 1958). On the basis of this research, a peak particle velocity of 2 inches per second is commonly used to express the threshold of damage to residential structures in sound condition.

Separate from the "safe" criteria that apply to vibrations and structures, the threshold intensity is rarely reached before complaints are registered by homeowners. Based on considerable previous studies (Goldman, 1948; Richart and Woods, 1969; Wiss and Parmlee, 1974), the relationship between human response and vibration intensity is also shown on Figure 9. By inspection, it is apparent that the vibration intensities subjectively classified as "disturbing" or "very disturbing" are well below the threshold intensity for structural damage (2 inches per second).

Recommendations

Based on past experience, vibration levels in the "distinctly perceptible" range may result in complaints or claims of damage. Accordingly, it is recommended that an intensity threshold criteria of 0.03 inches per second be used to limit vibrations generated during pit operations.

The vibration intensity criteria described above should be used as a starting point for establishing a set of pit operation standards. These criteria may require revision as actual data are gathered during the recommended instrumentation and monitoring program. It is further recommended that as pit operations advance toward existing residences, that the structures be inspected in detail for the presence of cracks, damage and defects. The inspection will serve as a baseline for comparison against any future claims of damage.



FROM: WISS, 1981

FIGURE 9
VIBRATION IMPACTS

2.6.4 Impacts to Land Resources

The two principal potential environmental impacts to land resources include the surface erosion that results in the formation of gullies and the contamination of soil with hazardous materials. A discussion of erosion control is presented in Section 2.6.8. The potential for the contamination of soil with hazardous materials and the practices recommended to avoid these impacts are discussed below.

Potential Contamination of Soil with Hazardous Materials

Operation of sand and gravel pits, concrete batch plants, and asphalt plants involve the use of a variety of hazardous materials. These materials may be present on site for the operation of mobile or stationary equipment or they may be required in the production process. Several
types of hazardous materials are necessary for the operation and maintenance of site equipment. This equipment includes mobile equipment such as trucks, front end loaders, and bulldozers, as well as stationary equipment, such as process equipment or generators. Operation of this equipment may require the storage of petroleum products, including fuels, oil, and hydraulic fluids, as well as antifreeze. Maintenance of this equipment may result in the storage of solvent for parts cleaning.

Hazardous materials are also required in some production processes. Asphalt plants mix oil with aggregate to form the finished product. Concrete batch plants mix cement with sand and aggregate to form the finished product. The storage of oil and cement represent the potential for releases that can contaminate the soils on the site.

The storage and use of these operation and maintenance fluids represent the potential for contamination of soil through either spills or leaks. Spills may occur from the fluid storage tanks or containers during filling of the tanks or containers or during filling of equipment from the tanks or containers. Spills typically involve short-term releases by may involve a substantial volume of fluid. Leakage of fluids from the tanks or containers storing the fluid is an additional potential means of fluid release. These types of releases can either be short-term (if the leak is visible or detected by leak detection equipment) or they can be long-term and involve large quantities of contaminants (if the leak is not visible nor detected by leak detection equipment.) A final potential means of soil contamination from these materials is through leaks of fluids from equipment. This source of contamination is typically slow in rate but over time the volume and extent of the release may be considerable.

The obvious impact of contamination of soil with hazardous materials is the negative impact on the capacity of the soil to support vegetative growth. This impact is of concern primarily after mining is completed and the land is available for other uses. Other impacts of soil contaminated with hazardous materials are impacts to humans from contaminant vapors and contamination of surface and ground water. Many of the hazardous materials used on site at these operations are volatile compounds or contain volatile components that will volatilize after being released into the soil. Many of these

volatile compounds are known or suspected carcinogens, and therefore represent a health hazard to humans in the vicinity of the releases. The risk is highest in the immediate vicinity of the release because the concentration decreases with distance as the contaminant vapor mixes with fresh air. Most releases of these materials would therefore not present a significant hazard to residents located at a distance from the potential releases. Contamination of surface water may occur as storm water runoff contacts soil that is contaminated with hazardous materials. Contamination of ground water can occur as surface water percolating through the soil contacts and dissolves hazardous materials and carries the dissolved contaminants downward until reaching the water table.

Recommended Practices to Prevent Contamination of Soil with Hazardous Materials

The following practices are recommended to prevent the contamination of soil with hazardous materials during mining operations:

1. *Institute standard practices to prevent the release of fluids during the transfer to or from tanks or storage containers. These practices should include, but not be limited to the following*

    a. *Checking of all hoses and fittings for leaks before and during transfer of the fluid.*

    b. *Ensuring that workers are aware of the location of shutoff equipment in the event of an accident during fluid transfer.*

    c. *Leaving room in the tank for thermal expansion of the product by not filling tanks to more than 90% of the tank volume.*

    d. *Verifying that equipment is shut off, drained, and not leaking after fluid transfer is complete.*

    e. *Maintaining adequate spill cleanup supplies and materials in the vicinity of fluid transfer points. Workers should be trained in the use of these cleanup supplies and materials.*

    f. *Notifying the appropriate facility personnel and regulatory agencies in the event of a spill.*

2. *Institute procedures to prevent the release of hazardous fluids from storage tanks or containers. There practices should include, but not be limited to the following:*

    a. *Regular inspections of above ground storage tanks or containers to monitor for leaks.*

    b. *Concrete secondary containment basins should be constructed to contain*

spills from above ground storage tanks or portable storage containers. The containment basins should have a volume of 1.1 times the volume of the storage tank or portable storage containers for complete containment.

c. *Barriers should be constructed to prevent vehicles from hitting above ground storage tanks, resulting in rupture of the tank and fluid release.*

d. *Leak detection procedures for underground storage tanks should be instituted as required by regulatory agencies to minimize the extent of contamination from a leaking underground storage tank. These procedures may include monitoring of the fuel inventory or leak detection equipment.*

3. *Institute procedures to prevent the release of fluids from leaks in equipment. These practices should include, but not be limited to regular inspections of both mobile and stationary equipment for fluid leaks. Leaks should be repaired as soon as they are discovered to minimize the release of fluids.*

4. The following practices are recommended to prevent the contamination of soil with hazardous materials after mining operations are completed:

   a. *Remove all above and underground storage tanks from the site to prevent future fluid releases.*

   b. *Remediate any soil that has been contaminated during site operations.*

By following the practices listed above, the potential for contamination of soil from hazardous materials will be eliminated, once mining operations are complete and alternative land uses instituted.

2.6.5 Impacts to Water Resources

There are several potential environmental impacts to water resources from mining operations. These impacts include the contamination of water with hazardous materials that are used on site, the increase in suspended solids from surface erosion, and the contamination of process water. The potential for these impacts are discussed below.

Surface water may be contaminated with hazardous materials as it contacts spill or leakage sites. These hazardous materials include petroleum products, solvents, and cement.

Surface water draining from the site can potentially carry dissolved or suspended hazardous materials off site. The surface water contacting hazardous materials may also dissolve hazardous compounds and percolate downward through the soil until reaching the water table. The hazardous compounds can then migrate offsite in the direction of the

ground water flow, resulting in the contamination of large volumes of ground water. This would potentially result in the loss of the use of ground water for drinking water or other uses.

Surface water may also be contaminated with sediment from the erosion of exposed surfaces, particularly during mining operations. Surface water draining from the site can potentially carry the suspended solids off site. The increase in suspended solids would impact primarily surface water because the soil would act as a filter for the solids as the water percolates downward. After mining operations are completed, the mining sites will be revegetated according to site reclamation plans. The potential for surface water degradation from erosion would therefore decrease due to the soil-holding capacity of the added vegetation.

There is potential for degradation of water resources from water generated during production of concrete and asphalt. The washing of concrete trucks or other containers produces an alkaline water that is high in suspended solids. Release of this water could result in degradation of off site surface waters through the increase in suspended solids and pH because of the lime present in the cement. The pH of ground water could also be increased, although the suspended solids would tend to filter out as the water moved through the soil. In addition, scrubbers may be used to control particulate emissions from asphalt plants. Scrubbers use fine sprays of water to capture the dust generated during asphalt production, resulting in process water high is suspended solids. Release of this water could result in surface water contamination. Ground water could be impacted to a lesser degree because of the filtering nature of soil.

Recommended Practices to Prevent Environmental Impacts to Water Resources

The following practices are recommended to prevent the contamination of water resources with hazardous materials during mining operations:

1. *Institute procedures to prevent the release of hazardous materials on site as described above. Develop and implement a Spill Prevention Control and Countermeasures (SPCC) Plan as required by regulatory agencies.*

2. *Develop storm water controls to minimize the erosion of surface soil and prevent the release of off site storm water runoff. Runoff is typically contained on site at the Beck Street facilities presently operating. Storm water runoff is allowed to evaporate, preventing sedimentation off site.*

3. *Water from process operations should be recycled on site. This is usually done at concrete washout facilities and also with the scrubber process water. Sedimentation basins allow the suspended solids to settle, allowing recycling of the process water. The solids are not considered as hazardous waste. The solids are recycled as raw material at the plant or used as fill material at another construction site.*

2.6.6 Buffers and Safety Barriers

Buffer Zones

A number of concerns regarding the negative impacts of active excavation were voiced during the public input process. These concerns addressed noise, vibrations from blasting and equipment operation, safety, air pollution, water pollution, dust, and visual nuisances. Concerns about negative post-excavation conditions such as land stability, erosion risks, slope safety and visual impacts were also raised.

The implementation of *excavation buffer zones* can help protect nearby properties from excavation operations. For the purposes of this section, excavation buffer zones are defined as the *perimeter area of an excavation property dedicated to mitigating the potential negative impacts of the extraction operation on adjacent and other nearby properties.* Such buffer zones should be located solely within the boundaries of the excavation use that exert the negative impacts.

The size requirements of excavation buffer zones will vary according to the neighboring land use and specific physical conditions such as slope, vegetative cover, the lay of the land and the location of adjacent uses. Since sand and gravel excavation is a more intense use than any other existing or proposed land uses in the area, the buffer required to protect neighbors should be based on the specific neighboring use.

Performance Overlay Zones

In order to ensure that the buffers between extraction industries and other nearby uses are adequate, Performance Overlay Zones are recommended for implementation. In combination with the standard industrial monitoring process, a Performance Overlay Zone system considers adjacent land uses in relation to the nature and intensity of excavation, thereby determining the most appropriate buffers and buffering techniques. If a residential use is developed immediately adjacent to an extraction use, an increased buffer and/or other measures might be prescribed through the Performance Overlay Zone to mitigate the negative effects of the extraction operations. If, on the other hand, open space is the adjacent land use, additional buffer distances may not be necessary, although enhanced buffering techniques may be. The Performance Overlay Zone should assure that the buffer mitigates the various negative effects associated with the excavation use.

As a minimum buffer, extraction industries should maintain the buffer requirements that currently apply. The City of North Salt Lake has recently required the Granite Pit to implement 50-to-100 foot buffers from the maximum excavation line. Salt Lake City requires that 30 to 50 foot setbacks from the property line be provided around the perimeter of a site in an Extraction Industries Zone, that 30 feet of the required setback be a "landscape buffer", and that no extraction or mining activities be permitted within 1000 feet of property zoned in a residential or institutional district.

Visual Buffers

Visual nuisances during excavation and disturbances to views after excavation are important considerations, especially when looking from the bench over the excavation activities below. Mechanisms to ameliorate these problems may be added to or naturally be part of the buffer zone[3]. Visual buffering techniques may include modifying land forms and constructing berms as physical and visual barriers; varying the distance between uses; modifying the slope and gradient between uses; planting vegetation or constructing fences and walls as physical and visual barriers; modifying the intensity of the excavation activity, redistributing the excavation activity to different parts of the site; or altering the time that the excavation activity occurs.

From the Beck Street level there is little visual benefit gained by placing buffers on the rear and side edges of the extraction industries, and great benefit gained from locating buffers along the front property line. From the bench the reverse is true, with little benefit realized from Beck Street buffers and great benefit gained from buffers placed along adjacent boundaries (buffers along Beck Street are addressed in Section 2.5.2 as part of an overall aesthetic enhancement program). Buffers should obviously be site specific and consider the view that is being screened.

Visual buffers are particularly critical between residential areas on the Bonneville Bench and adjacent extraction industries. Implementation of appropriate buffers between these uses can ensure that the visual impacts of on-going extraction operations and post-extraction site conditions are mitigated. It is essential that a visual buffering program be integrated with overall land use planning for the area and be addressed in the reclamation plan.

An appropriate ridge line is discussed in Sections 2.2.3 and 4.3.1 as a means for mitigating visual disturbances on the bench from adjacent mineral aggregate properties. The reclamation ridge line should ensure that critical open space features are left intact and are not excavated.

Safety Barriers

In order to ensure that post excavation slopes do not pose an undue hazard to those living or recreating on adjacent properties, the following techniques are proposed to help minimize the risks of people accidentally falling over the top edge of the slopes.

In general, safety barriers should be located in the buffer zones between extraction uses and residential uses on the City of North Salt Lake bench. Since many of these barriers can potentially impact the visual continuity of the bench, they should be selected and sited in a sensitive manner. The range of potential safety barriers include fences and

[3] Kendig, Lane; Performance Zoning, American Planning Association, 1980.

walls, berms and ha-ha's, the latter which provide physical separation while maintaining uninterrupted views over medium-and-long distances. Detailed studies will be required as specific development proposals emerge in order to determine the best type and location of barriers.

Warning or hazard signs are a critical component of a safety barrier program. Warning signs should be located above the steep upper slopes of excavation areas adjacent to other uses. In particular, the western edge of the Bonneville Bench should be signed. Carefully designed warning and hazard signs should inform residents, hikers and other bench users of the impending hazard of steep slopes and cliffs. The warning signs should be simple yet visible, designed and sited in a fashion that does not disrupt bench views over the valley floor or views of the hillside from the valley floor.

2.6.7 Geologic Hazards, Slope Stability and Rockfall

Sand and gravel processing operations will reclaim the properties that are mined, prior to the properties being converted to other land uses. The proposed performance standards for mines in the study area are included in the *DRAFT Ordinance* included as Appendix C. An additional Element of this report, titled Baseline Natural Resource Studies for Beck Street Reclamation Framework and Foothill Area Plan[4] includes standards for building offsets from active faults, building offsets from the base of rockfall-prone slopes, maximum slopes, re-vegetation, and erosion control. This section summarizes these proposed standards for the industry.

Geologic Hazards

There are several active faults in the region. A segment of the Wasatch Fault Zone, known as the Warm Springs Fault, passes through the study area. An earthquake along this fault could result in significant ground shaking and surface fault rupture. The shaking could damage or even collapse structures that have not been adequately designed or constructed. The shaking could also liquefy the sandy soils along the western portion of the site. When soils liquefy, building foundations can fail, resulting in damage to the overlying structure. Surface rupture could also result in significant damage or collapse of buildings located over active faults.

Recommendations

The following recommendations address the earthquake hazard within the study area:

1. *All structures proposed within the study area should be designed and built to UBC Seismic Zone 3 standards, as a minimum. Critical facilities should have a site-specific seismic analysis performed.*

[4] A copy of this report is available at the Salt Lake City Planning Division office.

2. *No building should be located over active traces of the fault. For planning purposes, no structure should be placed within the surface fault rupture risk zone without site specific analysis to define the nature of fault deformation and determine an adequate setback distance for the structure. The setback distance should be based on the width of the zone of deformation adjacent to faults, plus a conservative buffer-zone to accommodate any unexpected deformation or fault shifting. For planning purposes a 100' minimum set-back distance can be assumed. Unoccupied structures such as utility lines, roads, and open-space uses (parking, green space and tennis courts, for example) may be located within the fault zone with the understanding and acceptance that deformation and damage may result during a large earthquake.*

3. *Site-specific liquefaction analysis should be performed prior to the design and construction of structures located in the high liquefaction area along the western portion of the study area.*

Slope Stability

The proposed zoning and land use for mining operations within the central portion of the study area (Staker Paving, Hughes & Hughes, Monroc, and Mary Clarke properties) allow for steep slopes along the proposed eastern excavation boundary. The final slope configuration along the edge of excavation should be designed to have an adequate factor of safety against slope failure. There are two prime forms of potential slope failure: a massive failure of the slope along a semi-circular, deep-seated failure, and smaller wedge failures within the benches of the slope. In the wedge failure scenario, a large rock mass could separate from the slope along intersecting joints/cracks, forming a wedge-shaped failure surface. The technical studies analyzed the risks of both types of failures, and found the wedge type failure to be the highest risk. The maximum slope recommendation provided below provides an adequate factor of safety for both types of failure, give the data available for the current technical studies.

Recommendations

The following recommendations address slope stability in the study area:

1. *The maximum slope on any portion of the final reclaimed surface, including the slopes between benches, that are located within the central portion of the study area should not exceed 60 degrees. This slope angle is based on analyses using rock joint patterns and orientations from the existing exposed surface. Therefore, it is essential that these patterns be re-surveyed and additional slope/wedge failure analyses be performed once the ultimate rock slope surface is exposed. The final maximum slope should be based upon this future analysis, but in no case exceed sixty degrees.*

2. *Elsewhere within the study area, maximum slopes should be based upon a site-*

specific geotechnical/geologic study.

3. *The risk of wedge failure applies to the slopes between benches. The inclusion of additional benches serves to flatten the overall excavated slope to less than 60 degrees. The number of benches are set by constructability, rockfall hazard (see following section), and other considerations, rather than slope stability considerations.*

Rockfall

Natural weathering of the exposed bedrock along steep slopes within the study area will result in rocks being loosened and falling down the slopes, creating a potential hazard. The number and width of benches along the final reclaimed slope affect the number of falling rocks which reach the base of the slope, and how far out from the base of the slope falling rocks travel. As noted above, the number of benches in the reclaimed slope do not affect slope stability, and become a design choice of the mine operators based upon constructability and other considerations.

Table 2 provides a summary of the rockfall analysis for a benched slope, with inter-bench slopes set at 60 degrees. The table shows the width of rockfall zones at the base of the slope for large rocks (6 feet in diameter) falling from the top of the slope, for various numbers and widths of benches. A bench width of 25 feet or greater is preferable if the bench is to serve as part of a trail from the Beck street level to the Bonneville Bench. Table 2 can be used as a guideline to set the width of a "no-build" zone at the base of a steep slope within the project area. The rockfall zone widths provided in Table 2 are altered slightly from the results of the statistics-based rockfall analyses, to insure conservatism and consistency when comparing scenarios of differing bench widths.

Recommendations

1. *Bench segments that will contain trails should be 25 feet wide or greater.*

2. *Once the final bench and slope configuration is set in the Mine Reclamation Plan, a "no-build" zone should be set at the base of the slope, based upon the risks defined in Table 2 (for maximum inter-bench slopes of 60 degrees), or risks defined in a similar fashion for lesser slopes. There is no strong guidance as to acceptable risk (0.5%, 1.0%, or 5% of falling rocks reaching a structure) within the literature. The level of acceptable risk is a policy decision that should be made by each jurisdiction. A definition of actual risk for a specific structure would require an assessment of the number of rocks per year that would actually fall. The distances listed under 1% in Table 2 can be used for initial planning purposes.*

TABLE 2
Rockfall Hazard versus Bench Configuration

Bench Scenario				Widths of Rockfall Zone at Base of Slope in Feet			
				Case			
number of benches	Bench width (ft)	interior (between bench) slope angle (degrees)	width of catch basin at base (ft)	farthest rock	0.5% of large rocks from top	1.0% of large rocks from top	5.0% of large rocks from top
4	20	60	50	180	160	129	110
4	25	60	50	150	130	120	100
4	30	60	50	140	120	120	80
3	20	60	50	250	170	160	110
3	25	60	50	180	140	130	110
3	30	60	50	180	140	130	110
2	20	60	50	250	210	180	130
2	25	60	50	290	210	160	130
2	30	60	50	200	160	150	130

2.6.8 Erosion Control

Exposed excavated slopes with residual surficial soils will likely erode unless revegetation and other Best Management Practices (BMP) are implemented. The eroded soils will lower downstream water quality, increase stormwater conveyance and detention structure maintenance requirements, and reduce the visual quality of the eroded surface.

Recommendations

The recommendations for reclaimed surface revegetation, which is the most important erosion control procedure, are described in the following section. Other general Best Management Practices (BMP) to control erosion include the following:

1. *Using erosion curtains (e.g., woven silt film) and hay or straw bales downslope of earthwork operations.*

2. *Refueling equipment within a designated staging area.*

3. *Restricting traffic to designated areas and haul roads.*

4. *Curtailing operations during wet weather to prevent excessive soil compaction.*

5. *Salvaging and protecting topsoil from erosion loss for use in reclamation and re-seeding work.*

In addition to BMP, erosion control measures are required to prevent undue soil losses and plant material. Relatively level areas, (less than 2:1 slopes) should be mulched with weed-free hay or straw (2,000 to 2,500 lb/AC), and this material crimped into the soil to prevent loss from winds.

Erosion control material should be used on sites with slopes steeper than 2:1, and should be used in conjunction with soil tackifiers (materials mixed into the soil which aid soil cohesion). Examples of erosion control material include jute matting, polyjute, and other geotextile. Soil binder examples include Soil Master and Soil Guard, which form a bonded fiber matrix.

2.6.9 Revegetation

Revegetation specifications have been developed from several sources, including field data that was collected on vegetation and the dominant plant species of the site and from recommendations provided in the Interagency Forage and Planting Guide for Utah (*Horton, 1989*). The specifications therefore use species that are recommended for various life zones and precipitation regimes for Utah but also include plant species that characterize both dry and moist sites of the Beck Street quarries. The advantage of using both sources is that a variety of cool and warm season grasses can be included in the seed mixes, and species that establish relatively quickly can be included to provide erosion protection.

Seed Mixes

As illustrated in Tables 3 and 4, two seed mixes have been developed for the area. One mix is for the drier south and west-facing slopes, and the other is for cooler north and east-facing slopes.

TABLE 3
Seed Mixes, South and West Exposed Slopes

Common Name	Scientific Name	Season (C=cool, W =warm)	Broadcast Rate (lbs. PLS/AC)*
GRASSES			
Pubescent wheatgrass	*Agropyron trichophorum*	C	2
Russian wildrye	*Elymus junceus*	C	1
Thickspike wheatgrass	*Agrophyron dasystachyum*	C	2

Bluebunch wheatgrass	*Agropyron spicata*	C	2
Indian ricegrass	*Oryzopsis hymenoides*	C	1
Prairie sandreed	*Calamovilfa longifolia*	W	1
FORBS			
Lewis flax	*Linum lewisii*	-	1
Palmer penstemon	*Penstemon palmerii*	-	1
Blanket flower	*Gaillardia aristata*	-	1
SHRUBS			
Big sage	*Artemisia tridentata*	-	50-100/ac
Oakbrush sumac	*Rhus trilobata*		75-150/ac
Rubber rabbitbrush	*Chrysothamnus nauseosus*		25-50/ac

**PLS/AC = pure live seed per acre*

TABLE 4
Seed Mixes, East and North Exposed Slopes

Common Name	Scientific Name	Season (C=cool, W =warm)	Broadcast Rate (1 lbs PLS/AC)
GRASSES			
Bluebunch wheatgrass	*Agropyron spicata*	C	2
Western wheatgrass	*A. smithii*	C	2
Sanberg bluegrass	*Poa sandbergii*	C	1
Indian ricegrass	*Oryzopsis hymenoides*	C	1
Purple three-awn	*Aristida purpurea*	C	2
Prairie sandreed	*Calamovilfa longifolia*	W	1
FORBS			
Lewis flax	*Linum lewisii*	-	1
Palmer penstemon	*Penstemon palmerii*	-	1
Wooly loco	*Astragalus mollissimus*	-	0.5

SHRUBS			
Hackberry	*Celtis reticulata*	-	50-100/ac
Smooth sumac	*Rhus glabra*	-	50-100/ac
Rubber rabbitbrush	*Chrysothamnus nauseosus*	-	50-100/ac

Application Recommendations

A number of soil preparation and plant material guidelines should be followed in order to facilitate successful revegetation. Hard-packed soil should be ripped prior to adding soil amendments and seeding. Moreover, areas with a smooth surface should be roughened to decrease erosion, increase infiltration of water, and provide diversity for vegetation establishment. A summary of recommended reclamation operations follows:

1. *Rip hard packed areas and roughen surface in all areas.*

2. *Place topsoil, or place and incorporate organic matter (Note: if topsoil is not available, organic matter at 15 to 30 tons per acre will be required. Otherwise 5 tons per acre of composted manure or 1 ton per acre of Biosoil is recommended.)*

3. *Apply seed and fertilizer (20-20-10 lbs/ac N,P,K, respectively), and incorporate into the top 2-inch of soil.*

4. *Apply mulch at 2000 to 2500 lbs/ac and crimp into soil on slopes less that 2:1.*

5. *Apply erosion control material on areas with slopes steeper than 2:1. Areas of steep slopes may be hydroseeded, and mulch (e.g., Silvafiber or straw), soil binders (e.g., Soil Guard at 2000-3000 lbs/ac), seed and fertilizer can be applied in one operation.*

6. *Shrubs should be selectively planted, depending on site topography and the species being used. Generally shrubs will be grouped on side slopes. Berms will be required to hold precipitation run-off at the base of each shrub.*

2.7 IMPLEMENTATION PLAN

The following schedule summarizes the actions and general phasing periods

recommended in the plan.

2.7.1 Schedule of Recommended Actions

Land Use				
	ACTION	RESPONSIBLE AUTHORITY	PHASING PERIOD	
			SHORT-TERM (0-10 YEARS)	LONG-TERM (10-50+ YEARS)
1	Implement recommended land use changes	NSL/SLC	X	X
2	Enforce "Open Space Residential" development on the Bonneville Bench	NSL	X	X
3	Develop the new access road as a parkway	NSL	X	
4	Designate Bonneville Shoreline Trail Corridor	NSL/SLC	X	
5	Designate Unnamed Canyon Park and northern-most park along Beck Street	NSL	X	X
6	Ensure Kern River Pipeline maintains required side slopes and buffers	NSL	X	X
7	Consider Kern River Pipeline Corridor for trail uses	NSL	X	X
8	Implement campus design for proposed business park	SLC	X	X
9	Upgrade Chicago Street Intersection	SLC	X	X

	ACTION	RESPONSIBLE AUTHORITY	PHASING PERIOD	
			SHORT-TERM (0-10 YEARS)	LONG-TERM (10-50+ YEARS)
10	Ensure excavation leaves "alluvial" fan formations for view lot opportunities	SLC		X
11	Develop detention ponds as indicated in the Preferred Land Use Plan	NSL/SLC	X	X
12	Link southern and central portion of business park with service road	SLC	X	X
13	Discourage direct access to lots from Beck Street	SLC		X
14	Develop Cliff Face Trail	SLC		X
15	Designate Warm Springs Fault Trail Corridor, Geological Park, Hell Canyon Park and east-west Trail System	SLC	X	X
16	Designate Lime Kiln for historic protection	SLC	X	X
	Zoning			
17	Implement zoning changes that reflect the preferred land uses	NSL/SLC	X	X
18	Carefully phase zoning changes to ensure current operations are maintained as desired	NSL/SLC	X	X

	ACTION	RESPONSIBLE AUTHORITY	PHASING PERIOD	
			SHORT-TERM (0-10 YEARS)	LONG-TERM (10-50+ YEARS)
19	Finalize a preferred excavation limit line	SLC	X	
20	Designate all public lands as open space	NSL/SLC	X	
21	Implement Performance Overlay Zones	NSL/SLC	X	
	Open Space and Trail Corridors			
22	Identify appropriate buffer zones within the extractive use boundaries	NSL/SLC	X	
23	Acquire key properties, utilizing tools and incentives	NSL/SLC	X	X
24	Consider instituting a Transferrable Development Rights (TDR) program specifically for the Beck Street/Foothill Zone	NSL/SLC	X	X
25	Consider official delineation of wetlands	NSL/SLC	X	
26	Prioritize preservation of public lands, bench lands and trailhead locations	NSL/SLC	X	X
	Site Enhancement and Aesthetics			
27	Limit site enhancement efforts to identified priority sites	NSL/SLC	X	X

	ACTION	RESPONSIBLE AUTHORITY	PHASING PERIOD	
			SHORT-TERM (0-10 YEARS)	LONG-TERM (10-50+ YEARS)
28	Utilize the identified "toolbox" of enhancements and art elements	NSL/SLC	X	X
29	Screen unsightly uses, improve entry zones, commence development of a greenway on the east side of Beck Street, develop a commuter bicycle route and generally clean-up the area around both sides of the road	NSL/SLC	X	
30	Develop Beck Street into a beautiful boulevard and entrance zone for both communities, implement enhanced streetscape program, construct fully-separated bike path, coordinate with surrounding land use changes	NSL/SLC		X
	Industry Standards			
31	Implement and monitor Best Available Control Technology (BACT) to ensure air quality compliance	NSL/SLC	X	X
32	Monitor noise impact levels to determine appropriate mitigating techniques on a case-by-case basis	NSL/SLC	X	X

	ACTION	RESPONSIBLE AUTHORITY	PHASING PERIOD	
			SHORT-TERM (0-10 YEARS)	LONG-TERM (10-50+ YEARS)
33	Establish pit operation standards to minimize vibration impacts	NSL/SLC	X	X
34	Implement suggested practices to prevent soil contamination	NSL/SLC	X	X
35	Implement Performance Overlay Zone to determine appropriate buffers between incompatible land uses	NSL/SLC	X	X
36	Develop appropriate safety barriers on a case-by-case basis to ensure that excavation slopes do not pose an undue hazard to nearby residents	NSL/SLC	X	X
37	Implement recommended actions to address earthquake hazard in the area	NSL/SLC	X	X
38	Limit the maximum slope of any portion of the final reclaimed surface to 60 degrees as indicated	NSL/SLC	X	X
39	Implement suggested practices to prevent rockfall	NSL/SLC	X	X
40	Implement suggested practices to prevent erosion	NSL/SLC	X	X

ACTION	RESPONSIBLE AUTHORITY	PHASING PERIOD	
		SHORT-TERM (0-10 YEARS)	LONG-TERM (10-50+ YEARS)
41 Follow suggested procedures for re-vegetating excavated slopes	NSL/SLC	X	X

3.0 EXISTING CONDITIONS

3.1 Natural and Environmental

The purpose of this section is to provide the results of the technical baseline studies performed for the study area of the Beck Street Reclamation Framework and Foothill Area Plan. Studies performed address site soils and vegetation, surface water resources, geology, and slope stability. This report is an abridged version of a more complete technical report[5], which is available on request from the Salt Lake City Planning Division.

3.1.1 Site Soils and Vegetation

The variable soils of the Bonneville Bench are classified as Stony Terrace Escarpments and consist of deep, well-drained, stratified sandy loam to clay loam. Stones and cobblestones make up 40 to 70 per cent of the volume in most places. Average annual air temperature is 49 to 56 degrees F., and the frost-free period is 130 to 180 days. Runoff is medium to rapid, and the hazard of erosion is high. These soils are suited for range and wildlife habitat. Site elevations are 4200 to 5180 feet.

Description of Areas with Characteristic Vegetation

Bonneville Bench

The slopes of the rolling Bonneville Bench vary between 9 and 21 percent. Vegetation is grassland dominated by intermediate wheatgrass, cheatgrass, and yellow sweetclover with scattered clumps of shrubs. Other grasses include ticklegrass, spike muhly, and wildrye. Forbs include salisfy, ragweed, storkbill, mullein, thistle, gumweed, snakeweed, allysum, woolly loco, and asters. Some mosses are present in the grass/forb understory. Shrubs include Gambel oak, skunkbrush, and hackberry.

Soils of the area are rocky, shallow (3 to 4 inches deep) sandy loam. Soils are nutrient poor except for potassium and low in organic matter. At a depth of greater than 4 inches, the soil is very rocky.

Bonneville Bench Slopes

Slopes below the Bonneville Bench and above the active mines are very steep, at 75 to 78 percent. The slopes are dominated by cheatgrass with other grasses including bluegrass, three-awn, wheatgrass, trisetum, ticklegrass, and spike muhly. Forbs include salsify, mullein, gumweed, sweetclover, ragweed, peppergrass, dyer's woad, and snakeweed. Scattered clumps of hackberry, rubber rabbitbrush, big sagebrush, skunkbrush, smooth sumac, and Oregon grape are present, especially in areas of rock outcrops. Disturbed slopes are very sparsely vegetated with weedy species including Russian thistle, sunflower, and Chinese elm.

[5] See Baseline Natural Resource Studies for the Beck Street Reclamation Framework and Foothill Area Plan, Dames and Moore, Salt Lake City, Utah (February 2, 1997)

The soil is very cobbly sandy loam. Most cobbles are 2 to 3 inches in diameter with some up to 7 inches in diameter. Rock outcrops are present in several areas. On flatter areas near the top of the bench, soil is deeper (up to 4 inches) dark brown loam . Nutrient levels, except for potassium, are low.

Lime Canyon

Lime Canyon is a very steep-sided, narrow foothill canyon that bisects the Bonneville Bench area. Side slopes are 36 to 47 percent and the streambed is 21 percent. Water from a spring has been diverted into a pipe, and flowing water was observed only at the lower end of the canyon during the survey. A small dam, probably for livestock watering, is downstream of the spring. The gentle, south-facing slope above Lime Canyon is dominated by cheatgrass. Scattered clumps of smooth sumac, rabbitbrush, hackberry, and bitterbrush are also present in this area. A large Chinese elm occurs near the top of the canyon. Dense Gambel oak dominates the side slopes of Lime Canyon, especially the north-facing slope. A large clump of maples is present on the north-facing slope in the upper part of the canyon. Woody vegetation within Lime Canyon also includes rabbitbrush, hackberry, skunkbrush, smooth sumac, Gambel oak, Oregon grape, wild rose, and bittersweet nightshade. Small areas of tall wheatgrass are present as well as some dock, milkweed, and mint. Cress occurs at pipe leaks where soils are moist.

Mined Areas

Except for a few small areas near the top of the headwalls that were not disturbed by mining, vegetation is lacking in the mine sites. Soils are nutrient-poor, as expected in bedrock strata. Due to high percentages of silt and clay, soil textures are classified as loam and silty clay loam.

Reclamation Potential

The potential for developing self-sustaining plant communities on the site requires an understanding of soils on steep slopes, and coarse textured soils without organic matter that occur as an end result of mining. In order to establish self-sustaining plant communities, it is necessary to determine how these limiting factors can be overcome. Fundamental to plant community establishment is the development of soils that are conducive to plant growth within constraints related to soil, slope, aspect and available water.

Limiting Factors

a. *Soils*

Soil analyses indicate that levels of nutrient-related parameters including nitrogen (as nitrate), phosphorus and organic matter are lower than recommended for plant growth. Only potassium is present in sufficient amounts. Cation exchange capacity is also lower than recommended. Although slightly alkaline, soils are within a pH range conducive to plant growth. Site levels of electrical

conductivity and the sodium absorption ratio are adequate for plant growth.

b. Slopes

The undisturbed steep slopes (75 to 78 percent) that occur on the site contain a relatively dense vegetation cover. Where disturbance has occurred, vegetation cover is sparse (<20%) and composed of weedy species. No vegetation occurs where mining has removed the topsoil and steepened slopes to even greater angles.

c. Aspect

Since most of the site is west-facing slopes of the Bonneville Bench, evapotranspiration levels are expected to be high. The slopes of Lime Canyon are north and south facing. Vegetation of the south facing slopes is similar to the west facing slope below the bench. The north facing slopes, however, have clumps of mountain maple, a species suited for cool, moist areas.

d. Available Water

Water-holding capacity is an important revegetation consideration in selection of appropriate plant species, especially given the low average annual precipitation of 14 to 18 inches. Soil texture and organic matter content are the principal soil factors that affect water holding capacity, although a number of site characteristics are also important (including slope and aspect). The low organic matter content and coarse texture, and presence of cobbles, especially at depths below topsoil horizons, combine to allow rapid drainage and to reduce the water-holding capacity in site soils.

3.1.2 Surface Water Resources

This study was performed to quantify surface water drainage in the study area, in order to plan for drainage and erosion control at the reclaimed site, and also to evaluate surface water sources that may be used in establishing revegetation. Surface water in the Beck Street project area has not been extensively studied. Only two studies, one by Monroc [Reclamation Projects, Inc. (RPI), 1996] and one by Staker (RPI, 1987), pertaining to this resource were located. Information presented herein was obtained from a review of the Monroc and Staker reports, topographic contours from USGS 1:24,000 series maps, information in the Utah State Division of Water Rights database and National Climatic Data Center records, and site visits performed as a part of this study.

Description of Surface Water Regime

General

As illustrated in Figure 10, four watersheds, all of which have headwaters east of the project area at an elevation of 6,100 feet, drain through the project area. From south to north they are Hell Canyon, Jones Canyon, Lime Canyon, and Unnamed Canyon. The

majority of land at elevations below the Bonneville Bench does not drain via these watersheds, but rather is collected in minor drainages or runs overland down to the valley elevation. Vegetation in the watersheds is primarily grasses at lower elevations, with gambel oak and other deciduous trees at higher elevations and near the stream channels. Soils in these watersheds are well drained, and stream gradients are generally steep (greater than fifteen percent).

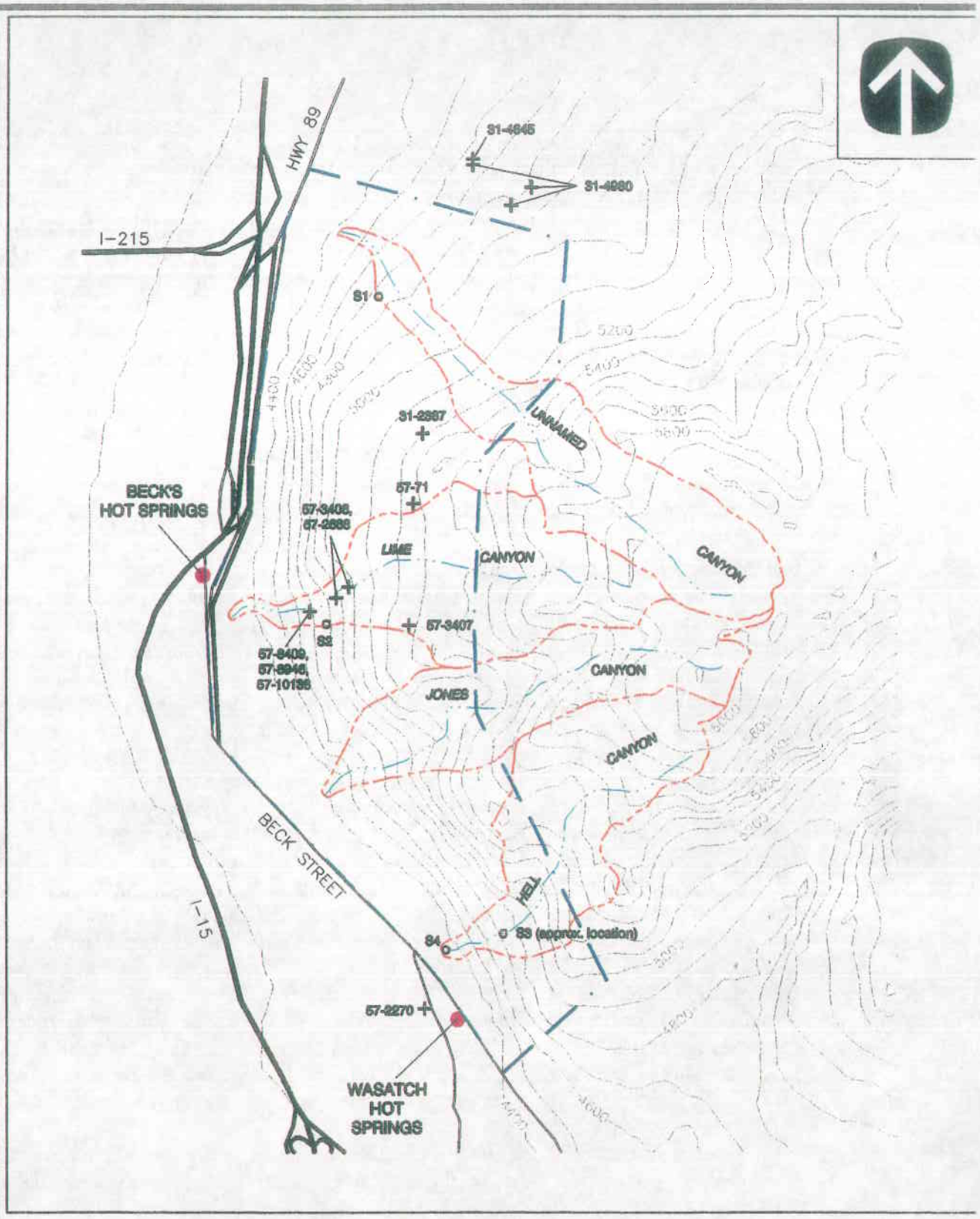
A number of springs are also located in the vicinity of the study area. Two of the larger springs are Beck's Hot Springs and Wasatch Hot Springs, with locations shown in Figure 10. In addition to the Beck's Hot Springs complex, for which there are a number of water rights, ten springs in the vicinity of the project are listed in the Utah Division of Water Rights database as having appropriated water rights. These are also shown in Figure 10.

A number of seeps are reported along the steep hills abutting Beck Street (RPI, 1996, and conversations with gravel company employees), often as a result of mining operations and/or spring runoff. Four perennial springs were found, either by reference in other documents or through conversations with gravel company employees and site visits. The one documented perennial spring without a water right, labeled S2 on Figure 10, is called the Section Corner Spring in RPI (1987), and is located just north of Monroc property. Three other perennial springs were visited. One spring, labeled S1, and a line of seeps along a cut face, were observed in the upper reaches of the CPC pits. Two springs, labeled S3 and S4, were located in Hell Canyon, on or near Rolfe Construction property.

Stream Flows

The four streams do not all flow year-round. Hell Canyon normally has no flow where it enters Rolfe Construction property. Kim Rolfe (personal communication, 1997) reported that he has not observed flow in the creek in the last nine years, even after large thunderstorms. Jones Canyon is reported to have flow only during spring snowmelt and in response to thunderstorms (RPI, 1987). Lime Canyon flows perennially for a short stretch along its lower reach on Staker property. Flow of 43 gpm was measured on February 6, 1987 (RPI, 1996). On February 10, 1997, a portion of the 63 gpm flow measured at diversion location 57-8409 in Figure 10 was observed flowing in the lower reaches of Lime Canyon. Unnamed Canyon only flows in response to snowmelt and rainstorms, and was not flowing in January-February 1997 (Pete Jones, personal communication, 1997). During a site walkover on January 15, 1997 along the Bonneville Bench (elevation 5,200 ft), no flow was observed in any of the streams at that elevation.

It is apparent that none of the streams can be used for a consistent water supply. Springs within these watersheds, discussed in the next subsection, are the only perennial surface water source.



1500 0 1500 3000

SCALE IN FEET

- PERENNIAL SPRING WITHOUT ASSOCIATED WATER RIGHTS
- SURFACE WATER RIGHT POINT OF DIVERSION (TYPICALLY SPRINGS)
- WATERSHED BOUNDARY
- CHANNEL
- PROJECT BOUNDARY

SURFACE WATER FEATURES

PROJECT AREA

SALT LAKE CITY, UTAH

Dames & Moore

Spring Flows

Five perennial springs were located below the Bonneville Bench elevation. These springs, either with water rights held by companies in the project area or with no associated water rights, could possibly be used for irrigation to establish re-vegetation in the reclamation area. Their total January-February flow was measured as approximately 81 gallons per minute (gpm). Of that, 6 gpm was in the Unnamed Canyon, 67 gallons per minute gpm was in Lime Canyon, and 8 gpm was in Hell Canyon. No spring flow was found in Jones Canyon

Summary of Potential Surface Water Sources

Based on a review of available studies and work conducted for this study, it appears that the only reliable sources of surface water within the project area, with no attached water rights or water rights held by companies in the project area, are springs located within the Unnamed Canyon drainage, Lime Canyon, and Hell Canyon. Total flow for these springs measured in January-February was measured as approximately 81 gpm (290,000 gpd), of which a spring in Lime Canyon had flow of 63 gpm. Summer flows may be somewhat less, although their magnitude has not been quantified. Issues in using this water to establish vegetation are quantity of water, as well as the ability and cost to distribute it to revegetation areas.

Alternate supplies of surface water to help establish revegetation may be secured by purchasing water associated with the uphill rights shown in Figure 10. Also, it is reported that CPC currently purchases water from an irrigation company to the north. This water may also be available for reclamation.

3.1.3 Geology and Slopes

Geologic Setting

The study area is located along the eastern edge of Salt Lake Valley, a deep, sediment-filled structural basin on the eastern edge of the Basin and Range physiographic province. The Basin and Range is characterized by north-south trending mountain ranges separated by linear basins or valleys. Salt Lake Valley is bounded to the east by the Wasatch Range of the Middle Rocky Mountain physiographic province and to the west by the Oquirrh Mountains and the Great Salt Lake. Thick sequences of unconsolidated lacustrine and alluvial sediments comprise the majority of the surficial deposits for the study area. Because of the significant deposits of Lake Bonneville sands and gravels at the site, a brief discussion of Lake Bonneville history follows.

Lake Bonneville History

Approximately 30,000 years ago, nearly 100 basins in the western United States contained freshwater lakes. The largest of these basins contained Lake Bonneville and was centered in northwestern Utah.

The water level of Lake Bonneville gradually increased before reaching its highest level of 1573-1585 meters above mean sea level. The lake culminated at this elevation about 16,000 years ago, creating a well-worn marker known as the "Bonneville" shoreline. The water level in Lake Bonneville dropped 110 meters about 14,000 years ago as a result of down-cutting and overtopping a natural dam at Red Rocks Pass in southeastern Idaho; thereby forming a lower shoreline referred to as the "Provo" Shoreline. Much of the gravel along the Beck Street foothills was deposited by the wave action of Lake Bonneville. Due to climatic factors the lake level continued to decline and finally, about 11,000 years ago, Lake Bonneville was at about the current elevation of the present Great Salt Lake.

Geologic HazardsGeologic hazards related to earthquakes and slope stability may present land use risks at the site. A reconnaissance-level geologic hazards analysis was performed for the study area.

Seismic Hazards

The study area is located within the Intermountain Seismic Belt (ISB), a 100 km- (62 mi.) wide, 1300 km- (800 mi.) long zone of active seismicity that extends from Montana to Arizona. Two large earthquakes (M>7) and about 20 moderately large earthquakes (M>6) have occurred since the 1880s. Earthquakes with M>6 occur somewhere in the ISB about every 5 years. A number of smaller earthquakes have occurred in historical time.

Earthquake Ground Shaking

Three seismic sources are capable of producing large earthquakes that might cause strong ground shaking of slopes at the site: the Wasatch Fault zone, the East Great Salt Lake Fault zone, and random earthquakes. The Wasatch Fault zone passes through the center of the study area, and is capable of producing a Maximum Credible Earthquake (MCE) of M = 7.5, yielding an estimated Peak Horizontal Ground Acceleration (PHGA) at the site of 0.3 to 0.4 g (with 5% probability of exceedance in 50 years). As these estimates exceed those for the other two sources, the MCE from the Wasatch Fault zone should be considered as the controlling earthquake for ground motion at the site.

Surface Fault Rupture

A complex pattern of north-south trending, active faults comprising the Warm Springs Fault Zone have been mapped across the site. Faults are considered "active" if they have ruptured the surface at least once in the past 10,000 years.

Liquefaction

Earthquake-induced soil liquefaction can present a significant risk to buildings and structures. Liquefaction potential maps have been prepared for Salt Lake County and Davis County. These maps provide a liquefaction-potential rating for zones based on the probability that within 100 years there will be an earthquake strong enough to cause

liquefaction. The ratings and associated probabilities are: Very Low (less than 5%), Low (5 to 10%), Moderate (10 to 50%), and High (greater than 50% probability).

The relatively flat, western portion of the site falls within the "High" liquefaction potential zone and the eastern sloping portion of the site is in an area identified as having "Very Low" potential for liquefaction

Tectonic Subsidence

Large-scale tectonic subsidence may accompany earthquakes in the Salt Lake Valley. Given the proximity of the site to the active Wasatch Fault, tectonic subsidence and resulting inundation of the Great Salt Lake could present a risk to facilities following a major surface-rupturing earthquake along the Salt Lake or Weber segment of the Wasatch Fault.

Seismic Seiche

Earthquake-induced seiche presents a risk to structures within the wave-oscillation zone along the edges of large bodies of water, such as the Great Salt Lake. Since the study area is located only a few kilometers to the southeast of Farmington Bay and the Great Salt Lake, it may be subject to some risk from seiche. However, seiche hazards associated with the Great Salt Lake have not been evaluated in detail.

Landslides

No landslide deposits have been mapped within the study area. The U.S Geological Survey has mapped a large landslide mass to the northeast of the study area boundary, but it does not appear to present a threat to stability at the site. Generalized geology and slope profiles have been prepared for several sections along the hillside and a discussion of the stability analysis is included in Section 3.4.3.

Rockfall

The rockfall hazard associated with the proposed highwall was evaluated with the aid of the Colorado Rockfall Simulation Program (CRSP). The rockfall model was based on a final slope comprised of four 50 foot wide benches connected by 60 degree slopes. A 30 foot wide (perpendicular to slope) and 10 foot deep rockfall catch basin located along the toe of the slope was included in the model. Rockfall clasts ranged in size from 1 to 6 feet in diameter were assumed to initiate from the crest of the highwall slope. One thousand rockfall scenarios were modeled for each size of rock (for a total of 36,000 runs).

The CRSP analysis suggests that 1.0% to 1.3% of rocks up to 6 feet in diameter would be likely to pass an analysis point 30 feet from the toe of the slope and only 0.5 % of the rocks would roll past an analysis point 60 feet from the toe of the slope.

Slope Stability

Evaluation of Massive Slope Failure

The purpose of the slope stability evaluation was to estimate risk of massive slope failure for proposed final gravel pit reclaimed slopes. The risks from more localized failures (wedge failures of smaller rock masses, rock falls) are discussed below.

Stability analyses were performed on four typical cross sections located within the central mining area within the study area (In the Staker Paving, Hughes & Hughes, and Monroc properties). Each section was analyzed for overall slope stability. The locations of four typical cross sections were chosen to represent the varying geology over the Beck Street site. Four different final cut slopes (55°, 60°, 65o, and 70o) were analyzed for each of the four cross sections. The slope angle was varied by assuming a fixed top of slope location and elevation and changing the location of the toe of slope. For the purposes of this study, the final base elevation was assumed to be the elevation of Beck Street at the location of the individual cross section. The slopes were modeled for static stability and failure surfaces yielding the minimum factor of safety were calculated for each cross section and slope angle. Each cross section and slope angle were also modeled for earthquake stability and failure surfaces yielding the minimum factor of safety were calculated for each slope.

Factors of safety were determined for each slope configuration, for static and earthquake conditions. The factor of safety represents the ratio of resisting forces (friction, cohesion, etc.) to driving forces (weight of the rock, etc.). In this case, a factor of safety represents the balance between forces causing and preventing failure of a slope. The higher the factor of safety, the more stable the slope. A factor of safety less than one represents failure of a slope. Minimum factors of safety of 1.5 and 1.0 are recommended, respectively, for static loading and pseudo-static seismic conditions (UDOT, 1996). These minimum factors of safety are slightly higher than those recommended by the committee on the Safety of Existing Dams (1.2 and 1.0, respectively, for static loading and pseudo-static seismic conditions, 1983).
Calculated factors of safety for both static and earthquake loading for a 60 degree slope for the chosen cross sections (through the Staker Paving, Hughes & Hughes, and Monroc properties) were above the recommended minimum factors of safety.

Evaluation of Wedge FailureA wedge failure is a failure along intersecting planes within discontinuities (joints, cracks) in a rock mass. The failure would likely involve much less rock/soil mass than the slope failure discussed in the preceding section. Preliminary stereonet analysis using estimated rock discontinuity data and the final pit slope angle indicates that as the slope approaches 60 degrees the potential for wedge failure increases. Given the apparent variability in strength and orientation of the rock, the potential for wedge, topple, and circular failures should be evaluated on a site-by-site basis as the final pit slope configuration is being excavated.

As the quarrying operations continue and bedrock is further exposed, new rock strength and discontinuity data will prove extremely useful in reviewing and revising the stability analyses for final cut slope configuration. Rock quality, orientation, and the location of shattered zones may prove to be significant factors in stability performance. Rock engineering parameter surveys should be continued during operations to help confirm trends and identify anomalous structures.

3.2 SPATIAL/VISUAL

3.2.1 Spatial Condition.

The study area is situated on the northern edge of Salt Lake City and the southernmost portion of the City of North Salt Lake. The study area is approximately 4.5 miles long, commencing in Salt Lake City at approximately 900 North and terminating at the junction of US 89 and Orchard Drive in the City of North Salt Lake. The study area stretches from Beck Street/US 89 to the eastern border of the Bonneville Bench for an average distance of 1.5 miles.

West of the site the land becomes progressively flat until eventually meeting the shores of the Great Salt Lake. The site is dominated by foothills that extend eastward into the greater Wasatch Mountain Range. The foothills are broken into five segments that are separated by four inconspicuous canyons with ephemeral streams. The natural vegetation around the canyons is more mature and pronounced than elsewhere, containing scattered clumps and individual specimens of mature trees and bushes. The relatively well-vegetated canyons break the monotony of the otherwise dry, grass-covered slopes of the west-facing mountainside.

The foothills are marked by two benches, remnants of ancient Lake Bonneville shorelines. The lower bench is called the Provo Terrace, and the upper bench is called the Bonneville Terrace. Large segments of the lower foothills have either been removed or are in the process of being removed as part of excavation operations. Excavation has already taken away much of the Provo Bench in the central portions of the site, and is exposing large vertical slabs of the underlying rock throughout the site.

The Bonneville Terrace is largely intact. It is a popular site for recreation activities such as hiking and mountain biking, and is the site of the Bonneville Shoreline Trail. The terrace is a natural uphill link between the communities of North Salt Lake and Salt Lake City.

The western edge of the site is marked by industrial and commercial activities, most of which are related to sand and gravel excavation. Warm Springs Fault runs through the transitional lower slopes near Beck Street. In the southern portions of the study area the

hillside has been scraped away, exposing the unique geology of the fault.

3.2.2 Visual Resources

The visual resources of an area depend on several inter-related factors, not least of which is viewer location. The visual impact of the hillside from long, medium and short distances are presented, followed by a discussion of long range views to the west from the Bonneville Bench.

Visual Resource of the Hillside as a Viewed from Below

The hillside is visible from long, medium and short distances. Long to medium views are typified by viewing locations at the Great Salt Lake, the Salt Lake City International Airport or Redwood Road. Shorter views are typical of locations along Beck Street.

Over the years excavation activities have modified the hillside, altering the visual resource of the area. The smooth and gentle slopes of the hillside have given way in places to vertical walls, man-made canyons and other geometric masses. Man-made alterations have disturbed the mountainside view. This is particularly apparent when viewing the site against the high snow-covered peaks of the Wasatch Mountains in the background of longer distance views. As the outer layers of the hill have been scraped away and removed, a colorful layer of underlying rock has been exposed, marked by switchback roads, geometric cuts and other man-made features. The colorful geology that has been exposed is considered by some to be an unexpected positive feature of the modifications. It is unclear if this will hold true as excavation extends further into the mountainside.

Visual Resource of the Hillside as a Viewing Site

The Bonneville Bench is a more-or-less undisturbed landscape feature that affords spectacular views over the Salt Lake Valley and the Great Salt Lake. The relative width of the bench provides a naturalistic setting of meadows, fields and scattered trees as foreground features, with long distance views of the valley and Great Salt Lake in the background.

To date, the negative effects of excavation have been minimal on the Bonneville Bench. This is due primarily to the fact that excavation has been kept to the lower slopes of the hillside. If excavation were allowed to extend into the bench, the effects could be devastating to the visual resource of the area. Not only would excavation threaten existing foreground views to the west, it would bring undesirable visual elements such as freeways and oil refineries into the viewshed, and disturb the otherwise natural edge of the bench.

3.3 TRANSPORTATION AND ACCESS

The study area is located in the midst of an important transportation corridor. This section discusses the current and future effects that Beck Street and Interstate 15 will

have on the study area. In addition, two proposed road projects are presented that could have significant impact on the study area. The first concerns the proposed extension of Bountiful Boulevard south over the Bonneville Bench into Salt Lake City, and the second is a proposal to construct a secondary access road from US 89 to the bench near the northern end of the Study Area.

3.3.1 Beck Street/US 89 and Interstate 15

The western edge of the site is defined by Beck Street/ US 89 (the road is called Beck Street in Salt Lake City, and US 89 in Davis County). Beck Street/US 89 is a minor arterial road that serves approximately 35,000 vehicle trips per day. It is used extensively by cars, trucks and buses, and is the primary access to the industrial areas located on both sides of the road. The road is slated to become an increasingly important commuter route, experiencing a substantial increase in vehicle trips in upcoming decades. The road is harsh and industrial in appearance, and has few if any pedestrian facilities such as sidewalks and street crossings.

400 West and Victory Road are the two major intersections along Beck Street within the study area. 400 West is controlled by a 4-way traffic light, and is envisioned to become a major access point into the downtown area. Victory Road is controlled by a 3-way traffic light, and is a major access to Capitol Hill and the downtown business district. Chicago Street is a less significant intersection at the moment, but is currently under design to be upgraded with a 4-way traffic light. The change is intended to help improve existing traffic conflicts between heavy trucks emanating from the variety of extraction industries on the east side of Beck Street.

Interstate 15 is located just west of Beck Street, and is the primary arterial highway for the Intermountain West Region. It is heavily used by residents and businesses throughout the Wasatch Front, and is the only north-south running highway of this classification serving the state. The freeway is linked to Beck Street with a northbound entrance just south of the county border. A southbound exit is located at 2300 North just west of the Study Area provides access to Beck Street via Chicago Street.

3.3.2 Bountiful Boulevard Extension

Various proposals to extend Bountiful Boulevard into Salt Lake City have been on the table over the years. Recent ideas focus on extending Bountiful Boulevard along the Bonneville Bench, past the County Line and down the hillside where it will eventually connect with 300 West in the vicinity of Victory Road.

This proposal has some demonstrated support, particularly from segments of Bountiful and the City of North Salt Lake residents living on the bench, and others interested in developing bench land. The contention of supporters is that the new roadway would shorten the commute between Salt Lake City for Davis County residents, and would generally improve movement through a bottle-necked bench community.

In Salt Lake City the proposal has met stiff resistance. The Salt Lake City segment of the Bonneville Bench is currently zoned for open space uses. Salt Lake City contends that the introduction of a road in the area is unnecessary, prohibitively costly and would have a devastating effect on the surrounding environment.

3.3.3 Northern Access Road

A secondary access road is proposed on the northern end of the Study Area that will connect the Bonneville Bench with US 89 near the intersection with Orchard Drive. The road would provide relief to existing residences north of the Study Area that are currently served by a single access road. The road would also provide access for additional residential development on the bench.

The terrain around the road is steep, is in various states of excavation, and will require extensive technical and monetary support to be realized. The road is supported in the City of North Salt Lake General Plan on the condition that new uphill residential densities be reduced and incorporate "Open Space Community" design principles (see Section 2.3.1 and 3.5.1 for details.)

3.4 LAND OWNERSHIP

There are 46 property owners in the Study Area. Ten of these properties are mineral aggregate sites. The Study Area covers an extensive area of almost 2,500 acres, with 19 percent of the Study Area in public ownership in North Salt Lake City and 54 percent of the Study Area in public ownership in Salt Lake City. The study area covers 1,643 acres in Salt Lake City and 818 acres in North Salt Lake City. Table 5 provides a summary of property ownership for the study area; a complete inventory of property ownership is provided in Appendix D. Study area properties are illustrated in Figure 11.

TABLE 5 - Property Ownership Summary

	Acres in Private Ownership	Acres in Public Ownership	Total Acres
North Salt Lake City	665	153	818
Salt Lake City	749	894	1043
Total Project Area	**1,414**	**1,047**	**2461**
Wikstrom Economic & Planning Consultants; Davis County and Salt Lake County Assessors, 1997			

In Salt Lake City, the bench is almost entirely in public ownership with the exception of those sand and gravel property owners who are excavating into the bench, and the private property owners of Mary Clarke and Edna Bates et al. On the bench, Salt lake City owns

LAND OWNERSHIP
BECK STREET / FOOTHILL AREA PLAN

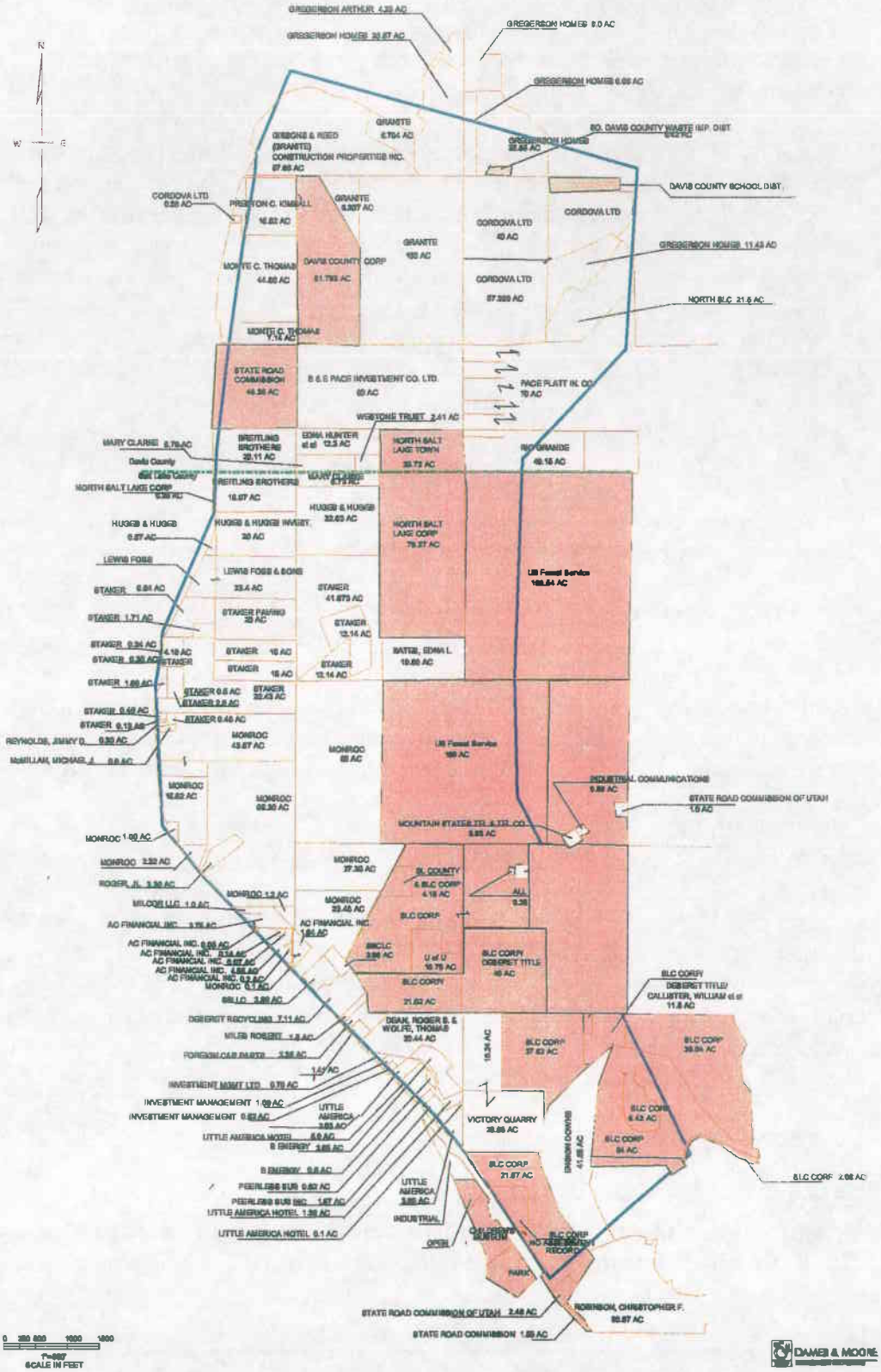


Figure 11

outright or in partnership with other entities 439.97 acres of land. The US Forest Service is the next major public property owner at 358.54 acres, and North Salt Lake City ownership follows at 79.27 acres. The Beck Street level properties in Salt Lake City are predominantly in private ownership.

In the City of North Salt Lake, properties along US 89 are predominantly in private ownership with the exception of the State Road Commission property. It is the intention of the State Road Commission to mine the property when other private sources of sand and gravel have been depleted in the area. The bench is predominantly in private ownership with the exception of North Salt Lake City, which owns a sizeable 42.20 acres of property, and Davis County, which owns 51.79. Davis County School District owns 10.00 acres on the bench, and Davis County Water Improvement District owns less than an acre..

Excavation properties identified in the plan have either recently been excavated, are currently excavating or could potentially excavate in the future (see Figure 12). These properties include Granite, Kimball, Thomas, State Road Commission and Breitling Brothers in the City of North Salt Lake, and Breitling Brothers, Foss Lewis & Sons, Hughes and Hughes, Staker, Monroc and Flandro in Salt Lake City.

3.5 LAND USE AND ZONING

At first glance it appears that the entire east side of Beck Street is one continuous extraction industry area. In reality there are two distinct jurisdictions on either side of the County Line (See Figure 13). Planning and zoning philosophies and development precedents vary between Salt Lake City and the City of North Salt Lake. Working toward a common position regarding extraction industries is a goal of this plan.

3.5.1 City of North Salt Lake

All land in the City of North Salt Lake portion is zoned either Highway Commercial (CH) or Residential (R-10 or R-12) or Special Use Restricted (SR). Highway Commercial (CH) zoning occurs adjacent to US 89 from the Davis County line, north to the intersection of US 89 and Orchard Drive. This narrow strip of Highway Commercial includes some undeveloped land, some land that is not developable in its current condition because of steep slopes, and portions of the northern end which have been mined for gravel extraction. The City of North Salt Lake officials have indicated that a change in zoning and land use policy is imminent.

Residential (R-10 and R-12) zoned property in The City of North Salt Lake allows single family residential development on 10,000 and 12,000 minimum square foot lots respectively. Most of this land is presently undeveloped, although there are extractive industries operating on some residentially zoned properties under conditional use permit. The Kern River Pipeline extends through the site in the vicinity of Unnamed Canyon.

PROPERTIES WITH EXCAVATION
OR FUTURE EXCAVATION
BECK STREET / FOOTHILL AREA PLAN

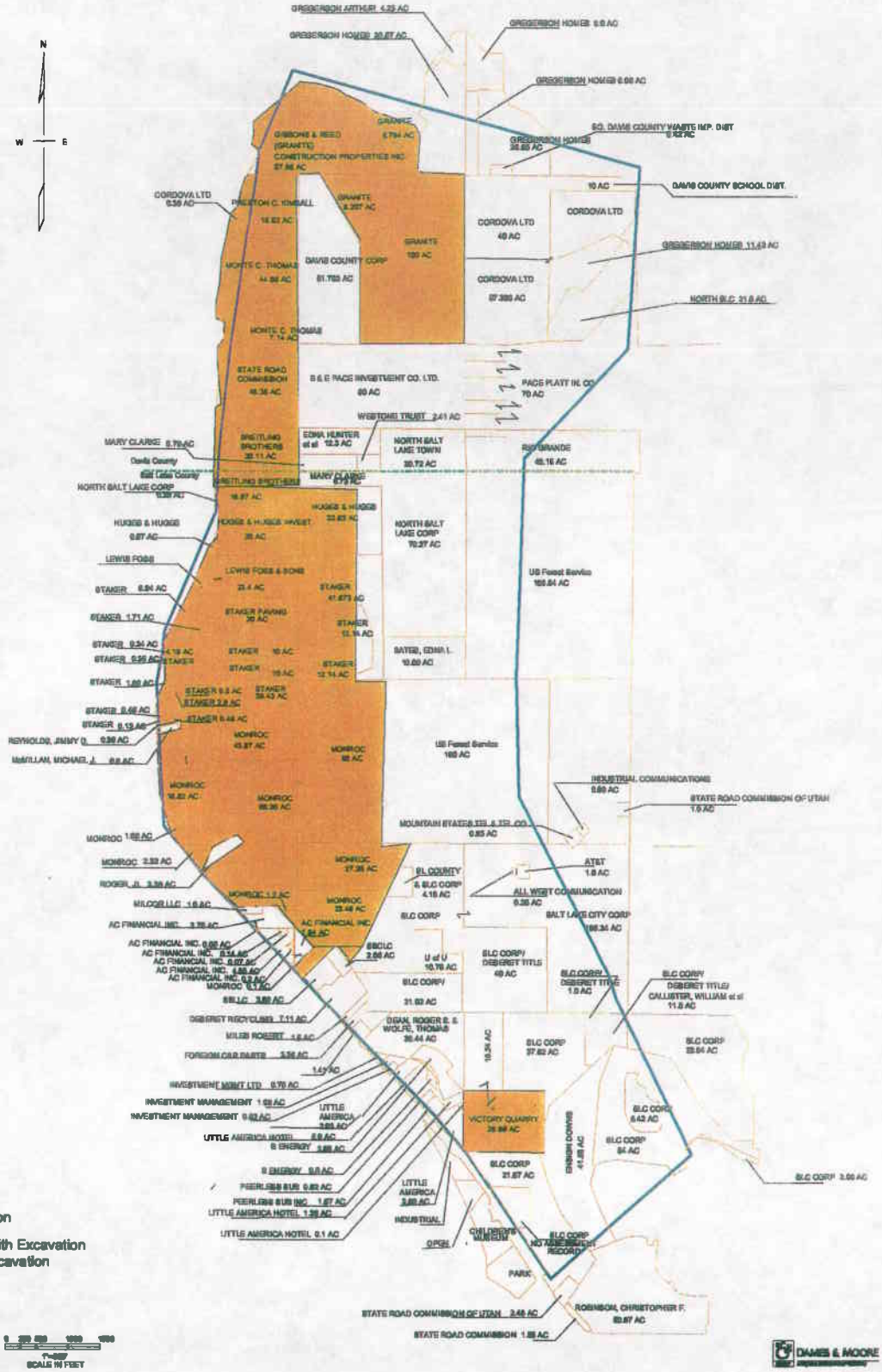
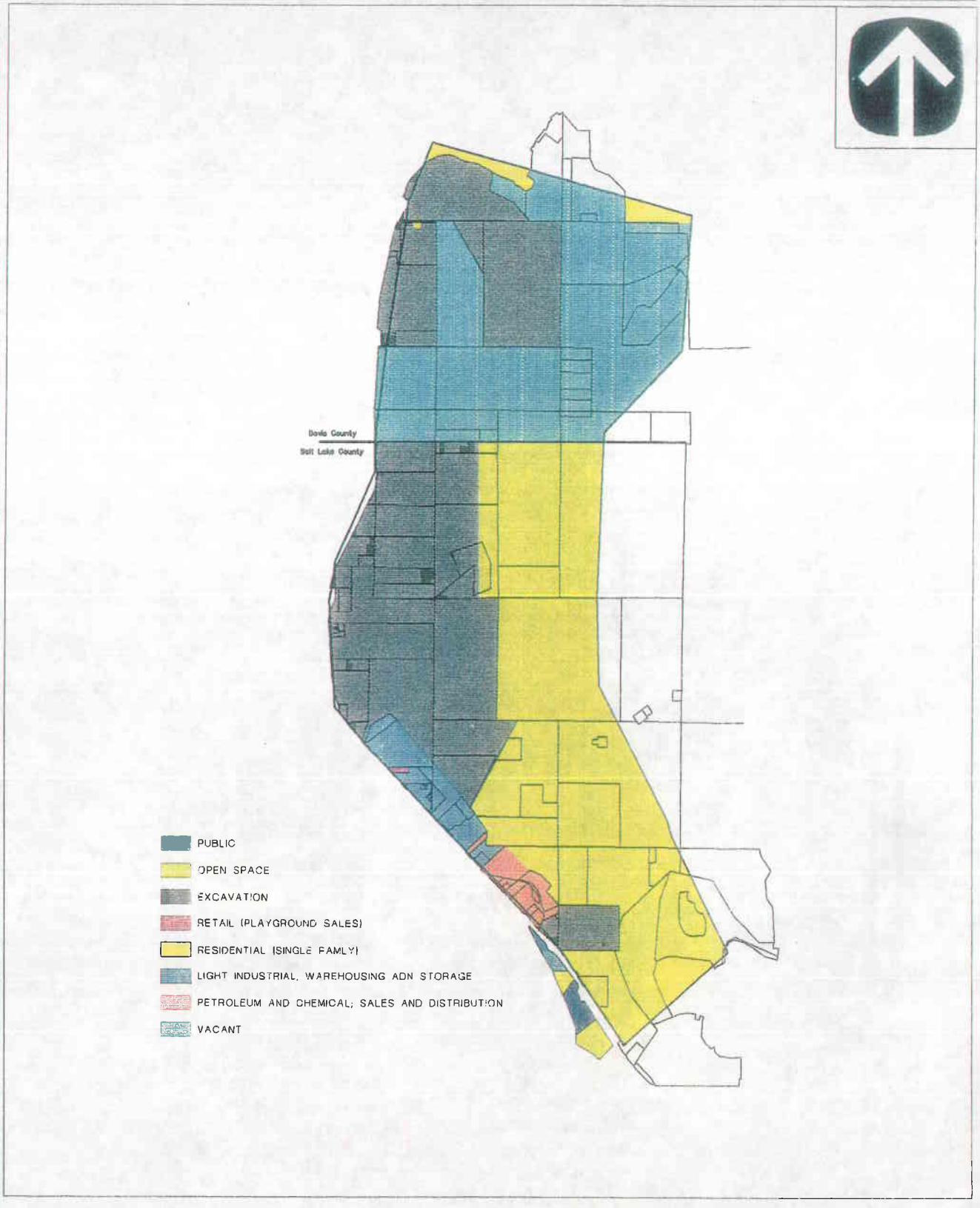


Figure 12



1500 0 1500 3000

SCALE IN FEET

EXISTING LAND USE

PROJECT AREA

DAVIS AND SALT LAKE COUNTIES, UTAH

Dames & Moore

FIGURE 13

The pipeline transports natural gas from a source east of the Wasatch Mountains to a distribution site west of the study area.

Recent planning efforts in the City of North Salt Lake encompassed in part the upper benches of this area of the City. The plan has been adopted by the City Council and amends the City's General Plan. It recommends that existing residential zoning be retained on those properties which are developable, and that residential development in the area be designed as an "open space community".

An "open space community" is described as an environmentally sensitive residential neighborhood which protects the existing landscape characteristics such as steep slopes and native vegetation. New development will emphasize clustered development so that open space is preserved and a network of trails and pedestrian friendly streets are interwoven throughout the neighborhood. Continuation of the Bonneville Shoreline Trail along the Bonneville Bench portion of this area is desired.

In the City of North Salt Lake, some extractive industries operate as non-conforming uses in residential (R-12) land. Special Use Restricted (SR)) zoning was recently applied to portions of the Davis County property and an adjacent property immediately to the south. This zone allows excavation activities as a conditional use. Lands which are currently zoned residential, and which are being used for the extraction of gravel, are identified in the new amendment to the General Plan to be reclaimed and eventually develop as residential land, assuming that an additional access road through the gravel pit can be constructed.

3.5.2 Salt Lake City

Properties in Salt Lake City are zoned either Open Space (OS), Extractive Industry (EI), or Manufacturing (M1). Current land uses are generally reflected in the zoning.

Most of the upper bench is zoned Open Space (OS) and includes both public and private lands that are currently undeveloped and are intended to remain so. The Open Space zone allows a minimum amount of development such as recreation facilities, parks and cemeteries. The bench includes a designated route for the Bonneville Shoreline Trail, which is an important regional trail, and other connecting trails to Ensign Peak and elsewhere in the foothills and beyond. An old rock-hewn lime kiln is found near the Provo Bench level of the hillside, just south of Hell Canyon. The structure was built for processing lime, and is believed to be one of the earliest structures constructed by the Mormon Pioneers. The lime kiln is believed to be of historic value, but is apparently not listed on the Salt Lake City Register of Cultural Resources or the National Register of Historic Places.

Existing gravel operations are located within the Extractive Industry (EI) zone. This zone is focused in the central portion of the Study Area immediately adjacent to Beck Street,

and to a smaller extent in the southern end of the study area between Victory road and the upper bench.

Manufacturing (M1) occurs on the southern end of the study area along Beck Street. The zone permits a variety of uses including those that already exist: light manufacturing, warehousing and storage uses; petroleum and chemical sales and distribution uses; and a small retail (playground equipment sales) use.

3.6 SAND AND GRAVEL OPERATIONS

During the public comment forums, gravel company owners and the general public expressed the need to develop a reclamation plan that considers the economics of the sand and gravel industry. The state does not have a natural resource plan providing an inventory of aggregate resources, so information was assembled from interviews with local sand and gravel businesses, and from local and national mining organizations.[6] Public outcry about the negative effects of the industry should be balanced with information regarding the supply and demand of aggregate resources on Beck Street. Questions about the industry that were raised in the public meetings should be answered.

Mineral Aggregates

Sand, gravel and rock aggregate are produced from natural sources or are manufactured (screened and/or crushed). These materials are differentiated by size: sand: 1/10- 2mm, gravel: 2-10mm, rock aggregate: over 10mm.

Mineral aggregates are a valuable resource for a growing economy. Different uses of mineral aggregates require meeting specifications set by different agencies such the American Society for Testing & Materials (ASTM), the American Association of State Highway and Transportation Officials (AASSHTO), U.S. Dept. of Transportation, the U.S. Corps of Engineers, and State highway departments.

There are tests to determine the characteristics of aggregates. Aggregates vary in characteristics such as bulk, weight, durability, compressive strength, inert chemistry or lack of reactivity, uniformity of composition and special features such as color, insulating value, and texture. For sand & gravel, there are magnesium and sodium sulfate soundness tests (frost resistance), durability tests, freeze-thaw tests (frost resistance), wet-dry tests, chemical reactivity tests, as well as abrasion and skid resistance tests (for highway construction). Depending on the use, there are abrasion tests (to determine abrasion resistance), soundness tests (to determine impermeability), gradation tests (relating to the size of stone for various uses), test for deleterious materials (relating to foreign materials), color tests (for decorative uses), tests for excess fine materials (too much excess fine materials will impede drainage), specific gravity (determining the solid volume), absorption tests (determining porosity and permeability), particle shape tests

[6] National Society of Mining Engineers, Utah Geological Survey, Utah Tax Commission

(some structures are difficult to crush), crushed count tests (for crushed gravel testing), and beam and cylinder tests for concrete (strength tests).

Substitute materials for excavated mineral aggregates include recycling of materials such as waste slags from burned rubbish and waste glass, slag as a byproduct of iron and steel production, grog as broken or crushed brick, and fly ash. Aggregates can be blended to meet specifications for a particular use.

3.7 ECONOMIC CONDITIONS

3.7.1 Economic Overview of Sand and Gravel in Utah

There are ten separately owned sand and gravel pits located along Beck Street in the City of North Salt Lake and Salt Lake City (see Figure 12) . These are part of a group of at least sixty pits that are spread along the Wasatch Front from Brigham City to Orem, and from Tooele to the Wasatch Mountains (see Appendix E).

In Utah there are no mineral resource zones that identify the available and most economical deposits. There is a large supply of sand and gravel in the valley, but the availability is limited by other types of development and the difficulties in obtaining permits to operate a quarry in close proximity to the various communities.

3.7.2 Market Considerations

The economic viability of the extraction industry is related to location in relation to the customer and transportation costs, the quality and quantity of the product, obtaining the mining permit, meeting regulations of the industry and plant costs.
The current uses for mineral aggregates excavated from Beck Street pits are typical of mineral aggregate uses nationwide. The main uses of mineral aggregates at Beck Street are for road base (in asphalt mixtures, and cement), and for construction materials (concrete, cement and graded fill). As the market dictates, mineral aggregate may also be used for mortar and plaster, bituminous aggregate, surface treatment such as seal coat, riprap for erosion control and jetty stone, railroad ballast, filter aggregate to backfill septic tank and drain filters, manufactured fine aggregate for sand blasting and exposed aggregate as concrete under bridges and terazzo.

A summary of discussions with representatives of the property owners or sand and gravel operators follows. The companies removing aggregate in the City of North Salt Lake portion of the study area include 1) Granite, which operates through a non-conforming use permit, which includes the recycling of asphalt, and 2) Breitling Brothers , which operates through a non-conforming use permit. The other pits along Beck Street in North Salt Lake City are not removing aggregate. The P.C. Kimball property has not seen production for over 35 years. According to the owner, excavation of mineral aggregate was constrained by the petroleum pipeline to the north and the gas pipeline to the south. The Monty Thomas property is now being used as a land-fill site with concrete and dirt

being deposited into the pit. The owners indicate that approximately 50 percent of the property has not been mined.

The companies removing aggregate from properties in Salt Lake City are permitted uses in an Extractive Industry (EI) Zone. These include Allroc, Hughes and Hughes, Foss Lewis, Staker, Monroc, and Rolfe Construction.

All of the owners removing aggregate indicate that due to the lack of top soil, little stripping takes place. The aggregate is pushed off the hill with dozers or front end loaders. Allroc, Hughes and Hughes, Foss Lewis, Staker, Monroc, and Rolfe Construction are drilling and blasting. Staker, Rolfe Construction, Hughes and Hughes, Foss Lewis and Monroc are crushing and screening the aggregate. The companies do not wash their aggregate because there is little clay to wash off the excavated aggregate. Some operations on the smaller properties are not stockpiling, but transporting as excavation occurs.

3.7.3 Employment and Income Tax

The 1992 Census[7] indicates there were 19 sand and gravel establishments in the state, and only two had more than 20 employees. There were two crushed and broken limestone establishments, one of which had 20 or more employees. According to the Department of Labor Mine Safety and Health Administration Mine Reference 1996, there were 28 sand and gravel operators in Utah. Eighteen of these had less than 10 full-time employees, six had 10 to 20 full-time employees and four had over 20 full-time employees. The 1996 average monthly wage for the Crushed and Broken Stone industry was $3,196. The average monthly wage of the sand and gravel industry in the same year was $2,116.[8] The average number of 1996 full-time employees in Salt Lake County for each sand and gravel company was 18.6, with an average projected annual payroll for full time employees of $472,290.

Since earnings generate fiscal revenues in the form of income tax payments, income tax revenues were calculated by applying the average effective state income tax rate of 3.91 percent.[9] The average adjusted state income tax for 18.6 full-time employee operation is $18,491. Applying this average operation size to the seven active pits on Beck Street results in projected income tax revenues to Salt Lake County at $129,440. More specific employee information for sand and gravel businesses in Salt Lake County is provided in Table 6.

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[7] 1992 Census of Mineral Industries for Sand and Gravel and Stone.

[8] Utah Directory of Business and Industry 1995-1996.

[9] Utah State Tax Commission, *Utah State Income Tax Statistics, Return Year 1994.* This takes into account adjustments made to earnings as dependent exemptions, itemized or standard deductions, and deductions for federal income tax payment.

3.7.4 Property Taxes

The total amount of real and personal property tax revenue accrued to Salt Lake and Davis Counties from active sand and gravel pits on Beck Street is $179,586, which is an average of $230 per acre, and from inactive sand and gravel pit sites is $7,649, which is $65 per acre (see Table 7 for details). In contrast, the amount of real and personal tax revenue accrued to the Counties from all other properties in the study area amounts to an average of $11,214 per acre (see Appendix E for details). The average taxable value per SF of property is $1.41 and the median taxable value per square foot is $0.45, while for sand and gravel pits the average taxable value per SF for active sites is $0.35 and the weighted median is $0.25 per Square foot. For inactive sand and gravel pit sites, the weighted median per square foot is $0.11 per Square foot with the median as $0.05 per Square foot.

In determining the total taxable value of real and personal property of the sand and gravel properties on Beck Street, the State of Utah determines the valuation of all mining, and the County applies the district tax rate. In 1996, this was 1.5448 percent for the area of the Salt Lake City gravel pits along Beck Street and was 1.3230 percent for the area of the City of North Salt Lake gravel pits along Beck Street. The State values personal property two ways and takes the higher of the two. One method is the income approach to value, and the other is the sales comparison approach using the fair market value of property. The state valuation of personal property includes the value and assets of all improvements on the property used *primarily for mining operations.* These include portable and fixed buildings and off road vehicles. The properties owned by sand and gravel companies that are not state assessed, are not considered part of mining operations and are county assessed. The mining property is valued based on what will be mined in the next year; state inspectors conduct a yearly site visit to maintain familiarity with the site and to factor-in market conditions. Not all of the area is taxed as mining due to the fact that sand and gravel may not be the highest and best use for the property. [10]

3.7.5 Price of Commodity

Locally, the Utah Department of Transportation (UDOT) is a large consumer of mineral aggregate products. Conversations with a UDOT engineer indicate that they receive bids that include the cost of the mineral, loading, transportation and loading on site. Ballpark estimates range from $8.00 to $10.00 per ton for free draining coarse aggregate (high permeability), and $5.00 to $6.00 per ton for coarse aggregate bought as granular borrow of 4" maximum size or untreated base (gravel). Crushed fine aggregate (sand) bought as fill costs between $4.00 and $6.00 per ton .

[10] Other taxes which mining operators are subject to include a Mineral Withholding Tax which is applied which is income tax at five percent of gross payment on interest or royalty. A sales tax at 6.225 percent in Salt Lake County, and a Corporation Franchise Tax at 5 percent on federal net income before net operating losses. There are no mineral severance taxes for this industry.

TABLE 6 - Payroll and State Tax Data in Salt Lake County, 1996

Sand & Gravel Companies in Salt Lake County	Number of Employees	Part-time/ seasonal	Projected total annual payroll for full-time employees	State income tax at 3.91 %	Location
Big Cottonwood Sand & Gravel	3	1	$76,176	$2,978	Portable 2 & 3
Big Cottonwood Sand & Gravel	4	1	$101,568	$3,971	Big Cottonwood
Blends Sand & Gravel	9	2	$228,528	$8,935	Pit #1
Croaker Construction	5	2	$126,960	$4,964	Croaker portable crusher
Eugene Morgan	9	2	$228,528	$8,935	Eugene Morgan & Sons
Falcon Ridge Construction	2	1	$50,784	$1,986	Falcon Ridge Construction
Foss Lewis	9	2	$228,528	$8,935	Benton Pit
Geary Construction	4	1	$101,568	$3,971	Portable Plant in Herman
Geneva Rock Products	12	3	$304,704	$11,914	West Valley Pit
Geneva Rock Products	17	3	$431,664	$16,878	Jordan
Geneva Rock Products	21	4	$533,232	$20,849	South Hansen
Geneva Rock Products	8	2	$203,136	$7,943	Pioneer Pit
Gibbons & Reed Company	8	2	$203,136	$7,943	2200 North Wash Plant
Gibbons & Reed Company	14	3	$355,488	$13,900	Hobusch Sand & Gravel Pit
Gibbons & Reed Company	21		$533,232	$20,849	Walker Sand & Gravel Pit
Harper Sand & Gravel	9	2	$228,528	$8,935	Pit # 14
Harper Sand & Gravel	6	2	$152,352	$5,957	Pit # 18
Harper Sand & Gravel	5	2	$126,960	$4,964	Harper Sand & Gravel
Harper Sand & Gravel	24	4	$609,408	$23,828	Pit # 10
Harper Sons & Gravel	3	1	$76,176	$2,978	Parley's Canyon pit # 16
Lakeview Rock Products	9	2	$228,528	$8,935	Lakeview
Monroc Inc.	9	2	$228,528	$8,935	NSL Sand & Gravel
Monroc Inc.	14	3	$355,488	$13,900	Point of the Mountain
Monroc Inc.	17	3	$431,664	$16,878	Kearns Plant
Salt Lake County Pit	4	1	$101,568	$3,971	Welby Pit
Salt Lake Valley	17	3	$431,664	$16,878	Salt Lake Valley Sand & Gravel
Sorensen Sand & Gravel	4	1	$101,568	$3,971	Sorensen
Staker Paving	31	4	$787,152	$30,778	Beck Street

Source: US Department of Mine Safety and Health Administration, 1996; Wikstrom Economic & Planning Consultants Inc., 1997

TABLE 7
Sand and Gravel Pit Real and Personal Property Taxes and Taxable Property Values in 1996

Pit Owner (operator)	Total acres	County assessed real estate	County assessed buildings	State assessed real taxable property	State assessed improvements	State assessed personal taxable property	State assessed TC-609 taxable value	Total taxable value of property	Taxable value per SF	1996 Taxes
Granite total	172.65	$89,570		$1,129,700		$1,337,900		$2,557,170	$0.34	$33,831
*Kimball total	16.91	$43,990						$43,990	$0.06	$582
*Thomas total	52.10	$43,060						$43,060	$0.02	$570
*State Road Commission total	48.35	$491,000						$491,048	$0.23	$6,496
Breitling Brothers total	39.08			$182,500	$8,000	$7,030	$316,170	$513,700	$0.30	$7,936
Foss Lewis & Sons total	23.40			$120,600	$2,000	$466,890		$589,513	$0.58	$9,106
Hughes & Hughes total	53.20	$16,300		$99,200	$61,400	$1,256,000	$537,400	$1,970,300	$0.85	$30,437
Monroc total	287.84	$736,800	$415,700	$2,396,400	$505,800	$366,890		$4,421,590	$0.35	$68,305
Staker Paving total	154.72	$114,000		$876,100	$52,700	$827,120		$1,869,920	$0.28	$28,887
Flandro total	29.98	$18,300		$89,200				$89,200	$0.07	$1,378
TOTAL	**878.23**	**$1,534,720**	**$415,700**	**$4,893,700**	**$629,900**	**$4,261,830**	**$853,570**	**$12,589,420**		**$186,951**

* = *Inactive Properties*
Source: Salt Lake County Assessor; Davis County Assessor; Wikstrom Economic & Planning Consultants Inc., 1997

Second price estimate was obtained from Salt Lake City Airport, which in comparison to UDOT has a fixed location. In 1996 the average price for sand and gravel (including transport) for a variety of projects at the airport was $6.28 per ton for P154, $7.17 per ton for P209, and $9.25 per ton for P301. Beck Street pits supplied 80 percent of the commodity purchased. In 1993, there were over 5 million tons of gravel purchased for the airport runway project. The cost was $2.75 per ton for type A (a processed material comparable to P154) and $2.75 per ton for type B (a processed material).

Prices quoted by pit operators/owners on Beck Street did not include transportation costs. The prices included $10/ton for landscape riprap and $2/ton for bank run. For half inch gravel an estimate of $3.75/ton was given and $4.25/ton for sand and gravel. Washed

manufactured sand sells for $4/ton and asphalt sells for $17/ton. It costs $1.75/ton for engineered fill and $3.75/ton for concrete gravel. The average cost of all aggregate is $3.25/ton -$4.00/ton.

3.7.6 Production

Production of sand and gravel includes acquiring the deposit, stripping, drilling, blasting, crushing, washing, screening, stockpiling, transporting, and meeting pollution and reclamation standards. Production plants may be portable or fixed plants. The representative open-pit production costs for a 272 tons per hour plant producing 453,600 tons per year with all-day operation for sandstone, limestone and dolomite quarries was $2.40/ton in 1991. This converts to $2.71/ton in 1997 dollars, based on the periodic interest rate from the Consumer Price Index.[11]

These costs include stripping, drilling, shooting, loading, hauling, processing, stockpiling, maintenance, dust control, royalty, selling, average variable costs, depreciation, and office overhead. Since the Beck Street pits are predominantly dolomite with limestone, the production costs are comparable.

Locally, the cost of production was derived by averaging the estimates quoted from gravel operators along Beck Street. Typical costs to produce a ton of sand are $4.57 and to produce a ton of road base are $3.37.

Transportation distance and cost of transportation will obviously have a major effect on profitability of the industry. It is nationally recognized that 20 miles is the typical maximum radius for transportation of mineral aggregates to maintain profitability. The Beck Street pit operators have confirmed this.

3.7.7 Future Demand & Costs

The demand for mineral aggregates is a function of construction growth and transportation growth. In Utah's booming economy, the demand for mineral aggregates will likely increase. Nationally, the average annual growth rate for sand and gravel consumption between 1921 and the early 1980's was 6.4 percent.

The cost of producing aggregate will be influenced by the regulatory requirements the industry is subject to. These include the control and/or mitigation of noise, dust, water pollution, waste pollution, water quality, traffic and appearance of property. Costs will also be influenced by requirements for land buffering zones around quarries and land use regulations, taxation, transportation costs, and worker health and safety standards.

3.7.8 Life of the Pits

At current annual production levels, some sites could be mined out within five years. As

[11] Industrial Minerals and Rocks, 6th Edition, 1994 pages 975-986.

some sites would be mined earlier than others, it is estimated to take 33 to 129 years for all mining activity to be finished on Beck Street. This is the time period to mine the 130 million to 364 million tons of aggregate estimated to be in the ground. Applying a 6.4 percent annual demand increase, this would considerably shorten the time period to between 19 and 37 years. If an estimated seven million tons of aggregate for the I-15 reconstruction project comes from Beck Street, the pits would be depleted one to two years earlier.

The varying estimates of the life of the pits presented in Table 8 illustrate two separate methodologies based on different assumptions. The highest estimate is based on half the base area of each sand and gravel property multiplied by an average bench height of 400 feet. The second estimate is based on information of remaining tonnage in the ground supplied by a number of quarry sand and gravel pit operators/owners, and by estimating tons of aggregate on properties which did not supply an estimate. Both estimates are based the assumption that the properties are mined to the property boundaries. The third estimate is based on a post-excavation final slope of 1V:0.7H (steep safe slope), while the fourth estimate is based on a less steep final reclamation slope configuration of 1V:2H

TABLE 8 - Life of the Beck Street Sand and Gravel Pits

Estimate Source	Total Cubic Yards of Aggregate	Total aggregate tons to mine on Beck Street	Value of aggregate based on average production of $3.65 per ton for sand or road base	Years to mine-out with 3,750,000 tons excavated annually	Years to mine-out with 3,750,000 tons annual production in 1997 and 6.4% annual demand increase
Based on November 1996 aerial survey and slope 1V:2H (slope permitting natural vegetation)	76,822,222	130,597,777	$1,795,066,639	33	19
Based on November 1996 aerial survey and slope 1V:0.7H (steep safe slope)	203,829,630	346,510,371	$1,264,762,854	91	32
Based on estimates provided by gravel pit owners/operators		252,010,000	$919,836,500	65	27

Wikstrom Economic & Planning Consultants Inc.; Dames & Moore

(slope permitting natural vegetation). Volumes of aggregate left to mine are derived from

a November 1996 aerial survey, and assumption of a 30-foot buffer zone from property boundaries. [12]

All estimates are based on the assumption that the excavation floor is level with Beck Street, that the Kimball property is mined out, that 100 percent of the identified sand and gravel properties are mined, and that the State Road Commission property on Beck Street will be mined out (UDOT intends to mine the site for mineral aggregate after private sources on Beck Street are depleted).

There are varying production levels at the quarries on Beck Street. The average capacity of crushed stone operation in the United States is 350,000 tons per year with a 100,000 to 5,000,000 tons per year production range. Considering the production of active sand and gravel pits on Beck Street only, the current aggregate annual excavation on Beck Street is 3,750,000 tons which is based on information supplied by gravel pit owners. For each of the pits, the least excavation activity is 100,000 tons per year and the most excavation activity is 2,000,000 tons per year. The average production of the active pits is 500,000 tons per year.

[12] Dames & Moore estimate of cubic yards from 1996 aerial survey.

4.0 ALTERNATIVES EVALUATED

4.1 ALTERNATIVE LAND USE SCENARIOS

As illustrated in Figure 14 , three land use alternatives emerged as the primary contenders for the area.

Alternative A suggested a business park theme, with high-image business, office and industrial zones proposed along the east side of Beck Street on both sides of the County Line. The business parks were to be designed in a campus-like fashion and integrated with open space and natural features. In this and all other alternatives, the area presently zoned Open Space (OS) in Salt Lake City was proposed for retention, as was all other publicly-owned land. The City of North Salt Lake property east of Beck Street was proposed for cluster residential uses in deference to existing zoning, with open space proposed for excavated sites and areas with slopes in excess of 30%. A road was proposed in all alternatives along the northern edge of the project, providing access to existing and future neighborhoods in the upper foothills. In all alternatives the natural drainage of the four canyons are acknowledged as an opportunity to channel storm water to collection ponds. The canyons are natural sites for connecting the Bonneville Shoreline Trail on the bench with Warm Springs Fault Trail at the Beck Street level. All alternatives recognize the recreation opportunity of Warm Springs Fault, Bonneville Shoreline Trail and associated parks and trailheads.

Alternative B is a mixed use scheme that proposes commercial uses along Beck Street, and cluster residential in the central excavated portion east of Beck Street. Areas designated for open space uses in the Bonneville Bench area are proposed for retention. All other sites are assumed to be excavated and re-developed as parks or cluster residential.

Alternative C is an open space theme. The area presently zoned Open Space (OS) in Salt Lake City was proposed for retention, as was most of the land owned by public bodies. The existing manufacturing area at the southern end of Beck Street was proposed for re-development into mixed-use commercial uses, and the large central excavated area was proposed for re-development as open space, including parks, playing fields and detention ponds. The City of North Salt Lake was again primarily residential in the upper reaches, with a large strip of mixed-use commercial land along Beck Street. Open Space corridors were proposed alongside the new access road, Unnamed Canyon and the Kern River Pipeline, guaranteeing trail and pedestrian access from Beck Street to the bench above.

4.1.1 Selection of the Preferred Land Use Alternative

The preferred alternative land use evolved in large part from input generated by the Steering Committee and public comment. Both groups indicated a preference for specific elements from each alternative. The spread of desires resulted in a preferred land use plan that combines elements of the three alternatives.

Figure 14

Alternative Land Use Scenarios

ALTERNATIVE A
- Business Park
- Open Space
- Open Space Residential
- Trailhead

ALTERNATIVE B
- Commercial Mixed Use
- Open Space
- Open Space Residential
- Multi-family Residential

ALTERNATIVE C
- Commercial Mixed Use
- Open Space
- Developed Open Space
- Open Space Residential

There was generally strong support for the business park concept and retention of existing open space in Salt Lake City. The location of cluster residential uses in North Salt Lake was generally accepted, although commercial development at the Beck Street level was considered unrealistic and undesirable. There was general feeling that development on excavated slopes in North Salt Lake was difficult and unrealistic, and should not be pursued.

Strong support was given to the formal designation of the Bonneville Shoreline Trail throughout the study area, and east-west trail linkages from the four canyons. It was also felt that the Chicago Street/1800 North intersection should be upgraded to improve short-term vehicle movements to the extraction industries, and long-term access opportunities to the business park.

4.2 ALTERNATIVE ECONOMIC SCENARIOS

The economic analysis in the plan considers a range of future scenarios for the hillside. At one end of the spectrum is a scenario where excavation ceases, and at the other end is a scenario where excavators will remove the full volume of aggregate permitted to existing property lines. Within these extremes are options that encourage bench preservation through open space preservation strategies. Not only is bench preservation affected by mineral excavation, on-going development pressures on the bench in both cities will influence the future of the area. The economics of open space strategies are discussed, from costly property acquisition at one extreme to less costly regulatory mechanisms at the other.

4.2.1 Option One: Cessation of Excavation

The possibility of sand and gravel excavation ceasing in the area was determined to be unlikely. There is no evidence that the market for sand and gravel along the Wasatch Front will decline or cease prior to full excavation of the resource. With increasing residential and business development along the Wasatch Front adding to the market for sand and gravel and with decreasing excavatable land in proximity to the development center, the Beck Street Pits appear to be well situated to continue their current rate of excavation of the foothills. The main uses of mineral aggregate from Beck Street, being road base and construction materials, are products that are likely to remain in demand for many years to come as the economy grows along the Wasatch Front.

In some cases sand and gravel pits cease production when the highest and best use of the land is for other uses such as residential, commercial or industrial development. This cannot be anticipated for the Beck Street pits during the foreseeable future. Excavation also gives the property owner more Beck-Street-level property for future development. In addition, property owners in Salt Lake City have vested rights for excavation in extractive industry zones along Beck Street. In North Salt Lake City, properties currently being excavated have been rezoned and conditional use permits have been approved, allowing excavation to continue as a conforming use. The Utah State Road Commission Property which, as a state agency, would not be required to abide by local zoning regulation if the

state should decide to excavate its property. For these reasons, it is expected that mineral aggregate mining will continue until the reserves are depleted.

4.2.2 Option Two: Excavation Along Modified Zoning Boundaries in Salt Lake City

Three alternative zoning boundaries were considered to define the limits of excavation, evaluate the qualitative impacts on bench open space, and determine the economic consequences to the sand and gravel property owners. These were:

Scenario 1: ***Existing Zoning***
In this case the volume of extractable gravel according to existing zoning boundaries and maximum slope agreements was estimated.

Scenario 2: ***Bench Preservation***
This alternative was developed through a series of Steering Committee meetings and a site visit. The prime criteria was to preserve all of the remaining Bonneville Bench within the Staker Paving/ Hughes and Hughes properties. This boundary essentially preserves the vista of bench visible from the reach of existing Bonneville Shoreline Trail uphill from the properties.

Scenario 3: ***Bench Preservation with Additional Preservation on Additional Land at Lime Canyon***
This alternative was the same as Scenario 1, with the preservation of additional land around Lime Canyon

The three zoning possibilities are compared based on the volumes of extractable material that would be permitted under these three scenarios. The degree to which property owners are willing to support a scenario is affected by the net loss or gain of land aggregate. The property owners affected by these scenarios are Monroc, Staker Paving, Hughes & Hughes Investment Company and Mary Clarke. These properties and the three scenarios are illustrated in Figure 4, page 12.

Volume estimates were calculated according to the following procedures. First, a base map was created showing topographic contours at five foot intervals. The mapping was based on a 1996 aerial survey, in a Utah State Plane projection. The property boundaries were overlaid on the map by referencing township and range boundaries to the Utah State Plane projection and inserting property boundaries according to the township and range description.

Next, maximum slopes for each edge-of-extraction property boundary were determined for each case from existing agreements or as determined from the Baseline Natural Resource Studies for Beck Street Reclamation Framework and Foothill Area Plan study of the technically safe slope. Table 9 provides a summary of the assumed slope constraints for each case.

A no-construction buffer of 30 feet was assumed from the property line to the edge-of-extraction boundary for property boundaries abutting open space. A plane elevation of 4300 feet (the approximate Beck Street elevation) was used for the base of the cut volume estimated.

Finally, the slopes for each boundary were input into the base map and fit to the terrain. The fitting at corners between right-angle property/zoning boundaries required rounding of the edge-of-construction boundary.

The volume estimates for each case are presented in Table 10. The volumes change for Scenario 1 and Scenario 2, with the numbers of 25 feet-wide benches selected for final reclamation. The number and widths provided in the table are at stable slopes. The choice between bench scenarios is largely an economic decision by the operators. The widths of benches are best left at 25 to 30 feet, which is the best width for pedestrian trail use should the benches be used for that purpose at a later date.

4.2.3 Alternative Open Space Preservation Strategies for the Bench

One of the main goals of this study has been to balance public and private interests in the bench area while preserving open space. As a response, strategies were identified with the intent of preserving as much of the bench as possible while remaining sensitive to future land uses and property ownership in the area.

It is important to acknowledge that open space has value, and the preservation of open space creates an economic asset for a community. As a starting point, a review of the economic indicators of open space value in current literature sources is provided. Many mechanisms are available for the preservation of open space in the study area. These include property acquisition, land donations, growth management programs, land uses encouraging open space, open space zoning designations and sensitive lands regulations. These approaches are not mutually exclusive; each approach needs to be addressed with respect to specific opportunities and issues.

Value of Open Space in the Study Area

Both Salt Lake City and North Salt Lake have acknowledged the value of portions of the Project Area as open space. The communities' open space desires and needs form the initial starting point for the preservation strategies. The foothill bench in the Project Area is quite beautiful and enhances life in adjacent communities. Community members use it for cross-country skiing in the winter and hiking in the summer. The views are wonderful, and in spite of the high degree of industrial use nearby, this area provides a sense of nature and isolation.

Salt Lake City has established an Open Space Zoning District in the Foothill/Beck Street Study area to preserve open space and limit development. Much of the bench is currently protected by this zoning designation. In addition, Salt Lake City's Open Space Plan

TABLE 9
SUMMARY OF DISTANCE BUFFER AND MAXIMUM SLOPE ASSUMPTIONS IN VOLUME CALCULATIONS

OWNER	CASE 1 Bench Preservation				CASE 2 Bench Preservation with more Lyme Canyon				CASE 3 Current Zoning			
	Distance Buffer (ft) from		slope (degrees) from		Distance Buffer (ft) from		slope (degrees) from		Distance Buffer (ft) from		slope (degrees) from	
	property line	zoning boundary	property line	zoning boundary	property line	zoning boundary	property line	zoning boundary	property line	zoning boundary	property line	zoning boundary
MONROC	30	30 (same as property)	60 plus bench	60 plus bench	30	30	60 plus bench	60 plus bench	30	0	60 plus bench	60 plus bench
STAKER PAVING	NA	0	NA	60 plus bench	NA	0	NA	60 plus bench	NA	0	NA	45
HUGHES & HUGHES INV.	NA	0	NA	60 plus bench	NA	0	NA	60 plus bench	NA	0	NA	45
MARY CLARKE	30	0	60 plus bench	60 plus bench	30	0	60 plus bench	60 plus bench	30	0	45	45
NA= not applicable												

TABLE 10
SUMMARY OF EXTRACTABLE VOLUMES AND TONNAGE, BY SCENARIO

OWNER	CASE 1 Bench Preservation			CASE 2 Bench Preservation with more Lime Canyon			CASE 3 Current Zoning
	2 benches	3 benches	4 benches	2 benches	3 benches	4 benches	
	Cubic Yards						
MONROC	86,000,000	84,700,000	83,500,000	86,000,000	84,700,000	83,500,000	90,100,000
STAKER PAVING	63,400,000	62,700,000	62,000,000	59,500,000	58,800,000	58,100,000	44,900,000
HUGHES & HUGHES INV.	18,900,000	18,500,000	18,100,000	18,900,000	18,500,000	18,100,000	15,500,000
MARY CLARKE	400,000	300,000	200,000	400,000	300,000	200,000	200,000
	Tonnage (1.85 tons per cubic yard)						
MONROC	159,100,000	156,700,000	154,500,000	159,100,000	156,700,000	154,500,000	166,700,000
STAKER PAVING	117,300,000	116,000,000	114,700,000	110,100,000	108,800,000	107,500,000	83,100,000
HUGHES & HUGHES INV.	35,000,000	34,200,000	33,500,000	35,000,000	34,200,000	33,500,000	28,700,000
MARY CLARKE	700,000	600,000	400,000	700,000	600,000	400,000	400,000

emphasizes the value of animal habitat, watershed, views, recreational opportunities, and decreasing risk of property damage caused by fire.

There is no corresponding open space zone in the City of North Salt Lake, and the bench lands here are more susceptible to development pressures from projects such as the Eaglewood development. However, open space preservation is supported through the City of North Salt Lake City's General Plan, which calls for open space residential development on the bench with emphasis on clustered development and open space integration.

As part of the Beck Street/Foothill Area planning process, community values have been identified regarding the visual characteristics of significant open space, such as certain hillsides and ridge lines, and the importance of the easy access to open space for many Salt Lake City and North Salt Lake City residents that the bench lands afford.

Intrinsic Value of Open Space

Open space has an inherent value beyond the demonstrated value for the study area:

1. *Open space enhances the quality of life* by adding aesthetic value to an area, preserving wildlife habitat and offering recreational opportunities.

2. *Recreation opportunities in open space areas are of value to the broader community* and for visitors to an area. Recreation could include more active pursuits such as hiking, mountain biking an cross-country skiing, or passive activities such as bird-watching , appreciating wildlife and enjoying a beautiful view.

3. *Environmental health of an area is enhanced by open space.* This includes preserving wildlife habitat, providing noise and air pollution abatement, flood control and ground- water recharge.

4. *The environmental impacts of development can be avoided* through maintaining land as open space.

The Money Which Public and Private Sectors Spend to Provide Open Space

Economic indicators of open space value can be illustrated by public and private investment to provide open space, the number of visitors to open space areas and user fees, the benefits to municipal budgets, and the replacement costs of open space.

One measure of open space value is to review how much tourists pay annually to visit open areas within the State and the national park areas. Utah has a number of counties where tourism is dependent on open space and recreational parks. There were 5.46 million visitors to the regional parks in Garfield County and 1.29 million visitors to the regional parks in Wayne County in 1992. As illustrated in Table 11, the 1992 amount spent in Wayne County was over seven million dollars (Wayne County includes

Canyonlands National Park, Capitol Reef National Park and four state parks). Travel is a growing industry in Wayne county, with a 20.2 percent average annual increase in the years 1990 to 1995. In Garfield County, which includes Bryce Canyon National Park, Capitol Reef National Park, Glen Canyon National Recreation Area, and three state parks, spending by travelers was over $47 million in 1992 with an eight percent average annual increase in the years 1990 to 1995. These park acres do not reside solely within these counties so the 1.8 million open space parkland acreage in the two-county area is over-estimated. This generates an under-estimated $29.31 revenue from travelers per park open space acre in the two counties combined, assuming that the over six million visitors to these parks in 1992 contributed significantly to traveler spending in these two counties.

TABLE 11
Visitor Spending Per Acre of Open Space,
Wayne & Garfield Counties, Utah (1992)

Wayne County Parks	Acres in 1992	Garfield County Parks:	Acres in 1992
Canyon lands National Park	337,570	Bryce Canyon National Park	35,835
Capitol Reef National Park	241,904	Capitol Reef National Park	241,904
Fremont Indian State Park	889	Glen Canyon National Recreation Area	1,236,880
Otter Creek State Park	80	Anasazi State Park	6
Piute Reservation State Park	40	Escalante State Park	1,351
Goblin Valley State Park	3014	Kodachrome State Park	2,241
Total acres in two counties: 1,859,810			
Spending by travelers in 1992	**$7,012,000**	**Spending by travelers in 1992**	**$47,498,00**
Total traveler spending in two counties: $54,510,000			
Traveler spending per acre: $29.31			

Source: Utah Travel Council, *1996 Economic & Travel Industry Profiles for Utah Counties*; Bureau of Economic and Business Research, David Eccles School of Business, *Statistical Abstract of Utah 1993 (Parks, Recreation & Tourism)*; Wikstrom Economic & Planning Consultants Inc.

Another measure of open space value is the amount spent locally to maintain parks and open spaces for the public. It appears that between $4,700[14] and $7,000 per acre is a predictable maintenance cost for parkland serving an urban community with appropriate park amenities. In 1991, Salt Lake City estimates the annual maintenance cost for parks to be $15,000 per acre for greenbelts and islands, $22,000 per acre for mini parks (a size less than 2 acres), $4,300 per acre for neighborhood parks (a size of 2 acres to 10 acres), $2,800 per acre for community parks (a size of 10-100 acres) and $4,500 for regional parks (a size of 100+ acres). Due to economies of scale and similar high costs of maintaining standard amenities as restrooms and play areas provided in small and large parks, the larger parks cost less per acre than the smaller parks. In FY 1991, Salt Lake City spent $2,242,300 for these parks with a total of 566 acres of parkland owned by the City[15], or an average of $3,962 per acre. In 1991, Salt Lake City had 4.45 acres per 1,000 population including Liberty Park and non city-owned parks such as the Jordan River Parkway and Sugarhouse Park and not including greenbelt/islands and miscellaneous facilities. North Salt Lake City owns approximately 17 acres of parks which provides 2.1 acres per 1,000 population[16] with a $119,000 maintenance budget in 1996 which would be an average of $7,000 per acre. This does not include the State Parks system that also operates within the two communities.

The Number of Visits to an Area From the Community and Tourist and User Fees

The 150-acre Eaglewood golf course adjacent to the foothill bench in North Salt Lake City drew approximately 55,000 people in 1996 and can accommodate up to 300 people a day. There were approximately 50,000 to 55,000 golfers in 1996 who played 18 holes of golf for a cost of $28 or nine holes of golf for a cost of $14.

Less developed amenities in Open Space areas bring in 90,000 to 700,000 visitors annually or between 50 visitors per acre of park for Millcreek and 170 visitors per acre of park for Jordan River State Park (see Table 12).

A survey of wilderness areas in Utah indicated that visitors spend about $30 per day to visit these areas for recreation purposes.[17] Demographic information on number of visitors to National Park Areas, including Monuments and Recreation Areas, indicates that there

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[14] These values are in 1996 dollars, applying inflation based on the Consumer Price Index.

[15] Not including miscellaneous facilities such as built recreational facilities as Steiner Aquatic, Heritage House and Parks Administration Building and not including greenbelts and islands in the public right-of-way.

[16] Population of North Salt Lake City estimated to be presently at 8,200 people.

[17] Wilderness Designation in Utah: Issues and Potential Economic Impacts, Utah Agricultural Experiment Station, Utah State University, January 1995.

were 11.7 million visits in 1990, growing at 3.5 percent annually.[18] Along the Wasatch front there were 230,407 visitors to Antelope Island in 1995, and 284,171 in 1996. Visitors to Bureau of Land Management Lands in Utah during fiscal year 1990 totaled over 7.6 million, primarily for camping (22 percent), river floating and boating (13.6 percent), hiking and backpacking(11.8 percent) and off road vehicles (10.1 percent). Other recreational uses included hunting, snowmobiling, other water based sports, fishing, winter sports, other motorized sports and site-based sports.[19]

TABLE 12
Visitation to Local Open Space Areas

Parkland	Location	Size (acres)	Visitation	Fees	Facilities
Great Salt Lake State Park	West of Magna	1,803	6,281,118	nil	Day picnic facilities, restrooms, boat ramp
Jordan River State Park	Salt Lake City	525	89,343	fees for golf course	Day picnic facilities
Millcreek Canyon Park	Millcreek	13,914	approx. 700,000 annually	$2.25 per non-commercial vehicle or $22 for annual pass	81% is national forest, day picnic facilities

Source: Utah State Parks & Recreation; USDA Forest Service; Salt Lake City Water District; Wikstrom Economic & Planning Consultants Inc. 1997.

Benefits to Municipal Budgets

Comparing municipal tax revenues to expenditures of each land use in a municipality creates an economic ratio to assess the costs of Open Space. Development creates municipal costs, evidenced by the rationale for development impact fees. A municipal budget reveals expenditures such as education, general government, public safety, public works (water/sanitation), and social services such as health and welfare and recreation and cultural amenities. These expenditures vary for different land uses. In a 1992 study conducted by the American Farmland Trust for 10 communities in Connecticut, Massachusetts, New York and Virginia, for every dollar brought in by Open Space/Farm Lands, or commercial/industrial, the cost is $0.30 (see Table 13.) For every dollar brought in for residential, costs are $1.16.

[18] Utah Office of Planning and Budget, Table 20, Rural Utah Tourism, April 1992.

[19] US Bureau of Land Management, *1990 BLM Facts & Figures for Utah*, in Rural Utah Tourism, April 1992.

TABLE 13
Open Space Benefits to Municipal Budgets

Location of study	Year of study	Open space/Farm lands	Residential lands	Industrial/ Commercial lands
A number of towns in Dutchess County, Maine	1989	average public costs of $0.38 for every revenue dollar	average public costs of $1.19 for every revenue dollar	average public costs of $0.25 for every revenue dollar
Boulder, Colorado	n/a	average annual public costs of maintaining lands: $328/acre	average annual public costs of maintaining developed and developable lands: $2,524/acre	
Wright County, Minnesota	n/a		greater costs than revenue for developed house lots larger than one acre by $490. Greater costs than revenues for quarter acre lots by $114.	
City of South Portland	1989	$1.29 in costs for each $1.00 in revenue		$0.94 in costs for each $1.00 in revenue

* Commercial and industrial growth encourage residential growth
Source: Land Trust Alliance, Economic Benefits of Land Protection

Replacement Costs for Open Space

Because open space in a natural condition is often considered a non-renewable resource (once lost it can never be truly replaced), it is difficult to assess a real replacement cost. However, there are recent examples of replacement of one type of open space - namely wetlands.

Wetlands are typically characterized by saturated soil and plant material that through centuries of equilibrium have created a stable complexity to survive. These sites provide groundwater recharge, water purification and animal habitats. Wetland mitigation costs are substantial and include earthmoving, water control structures and planting. Some examples of recent wetland replacement costs are illustrated on Table 14. As can be seen, wetlands replacement costs range from $13,000 to $50,000 per acre.

TABLE 14
The Economics of Wetland Mitigation

Location of Wetland	Agency	Acres	Cost per acre to re-establish wetlands
Creation of wetland west of the airport	Salt Lake City Airport Authority	465	$13,000
Replacement of wetland near Copperton	Kennecott Copper	7	$50,000
Provo Canyon Wetland	UDOT	6	$40,744
Brigham City to Mantua	UDOT	9	$37,333

Source: Statewide Wetland Mitigation Banking Feasibility Report and Agency interviews; Wikstrom Economic & Planning Consultants, 1997
Note: These figures do not include land costs

Better Bonding Rates for Municipalities
Capitol investors reward municipalities with better bonding rates when municipalities have a sound growth plan. Open space preservation can be seen to be an important component of a growth plan.

4.3 ALTERNATIVE LANDFORM MODIFICATION SCENARIOS

4.3.1 Visual Simulation

A series of alternative landforms for the study area were developed and analyzed. These were presented at Steering Committee meetings and public open houses prior to the April, 1997 series of open houses.

These alternative landform scenarios follow:

a) Slope Permitting Vegetation
This alternative illustrated maximum slopes at 2 horizontal to 1 vertical, and flatter. These slopes were estimated to be in the maximum range for supporting re-vegetation.

b) Safest Steep Slope
This alternative illustrated maximum slopes set to the steepest safe slope of about 0.7 horizontal to 1 vertical, with excavation to the eastern property boundaries. These slopes could not support vegetation;

c) ***Composite Design Alternative***

This alternative combined excavation to the steepest safe slope within the central study area properties (Hughes and Hughes, Staker, Monroc) and the southern study area property (Victory Pit), with re-vegetated slopes (2 horizontal to 1 vertical) within other properties. This alternative included a feature designed to draw attention to Lime Canyon (Staker property). This feature (see Figures 15 and 16) was a landform staircase which provided access to the Bonneville Bench from a central access point within the Study Area. This alternative had two variations: Alternative AA had excavation to the existing zoning boundary, and Alternative AB had excavation to the property boundary.

Visual simulations of a final reclaimed landform were developed for four viewsheds for each of the above alternatives. Figure 15 shows one of these viewshed simulations, taken from a vantage point of Redwood Road at the Salt Lake and Davis County line. Figure 16, a computer image of the landform viewed from above, was also provided as an alternative representation of the alternative topographies.

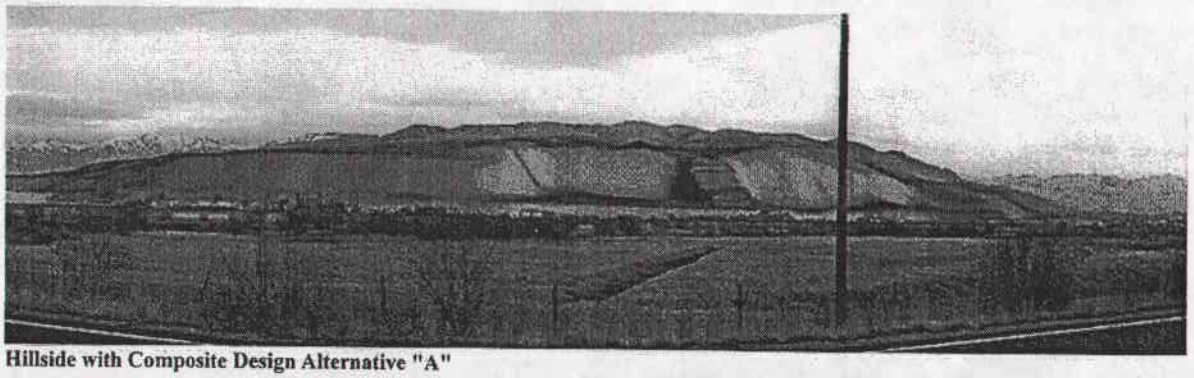
Figures 15 and 16 were displayed in the April Open Houses in Salt Lake City and North Salt Lake. Comments were received both from the public and from the Steering Committee. These comments are summarized in Appendix A. In general, there was no consensus choice for any of the alternatives presented.

4.3.2 Selection of a Preferred Excavation Limit Line

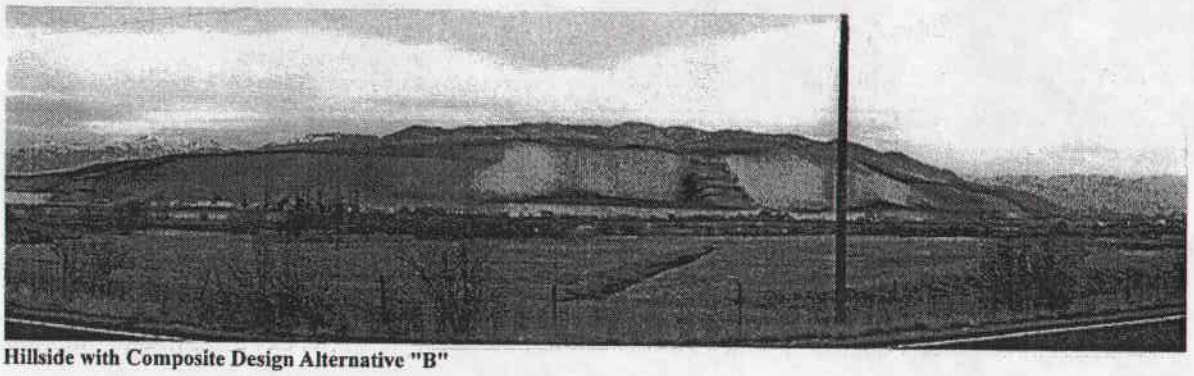
The visual simulations, coupled with preliminary economic analyses, served to re-direct the focus of the Steering Committee. Prior to the April Open House, discussions centered around the visual impact of the Study Area when viewed from the west (Salt lake City International Airport, Redwood Road, and Beck Street, for example). During a Steering Committee meeting which followed the Open House, preliminary economic analyses were presented which showed that re-vegetated slopes would result in a loss to the gravel pit operators of over half their currently zoned resource. This led to a consensus conclusion that re-vegetation of the reclaimed slopes was not practically achievable.

After further discussion and a field trip by the Steering Committee on June 20, 1997 to the Bonneville Bench, the focus shifted to another major issue: the preservation of the Bonneville Bench. An alternative was developed which preserved the entire flat-slope portion of the Bonneville Bench within the Hughes and Hughes and Staker properties, and which provided a smooth transition to the property boundary within the Monroc property.

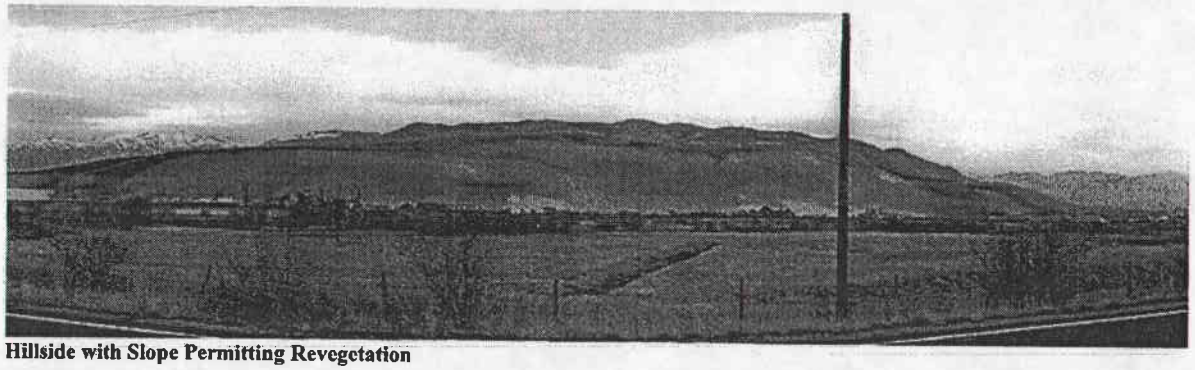
The preferred alternative is the Bench Preservation Alternative (Case 1 in Tables 9 and 10), which is depicted in Figure 17. The staircase landform feature that was originally proposed was abandoned by consensus, and replaced by a cliff face trail that meanders up the exposed face of bedrock between Hell Canyon and Lime Canyon.



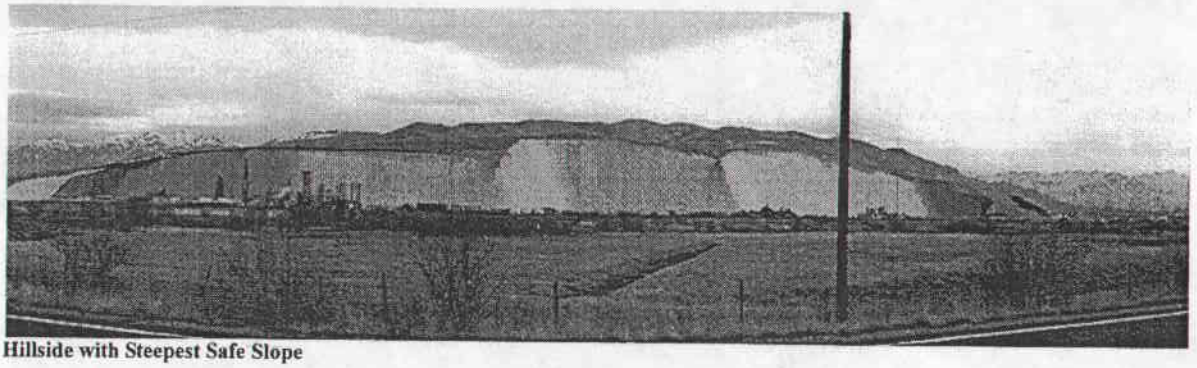
Hillside with Composite Design Alternative "A"



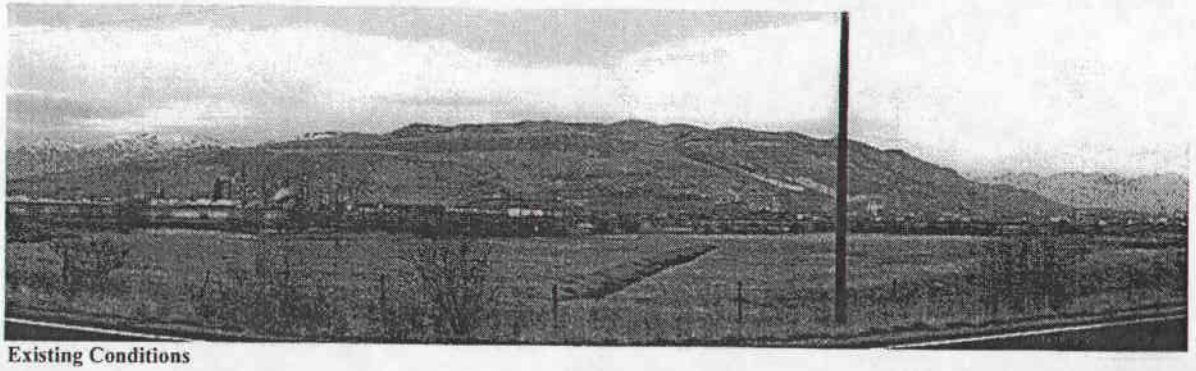
Hillside with Composite Design Alternative "B"



Hillside with Slope Permitting Revegetation



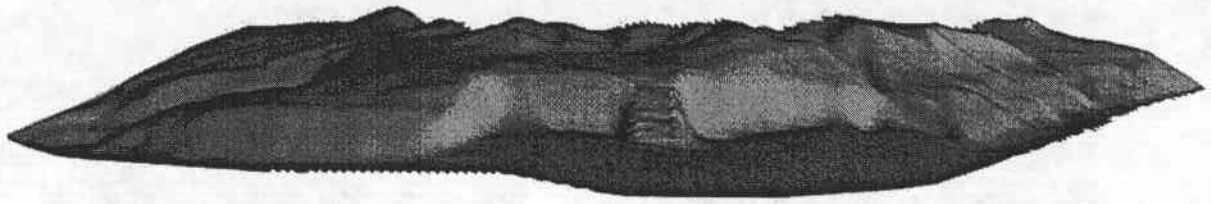
Hillside with Steepest Safe Slope



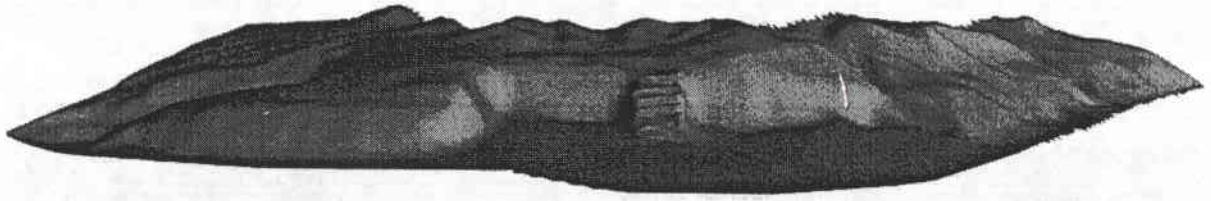
Existing Conditions

FIGURE 15

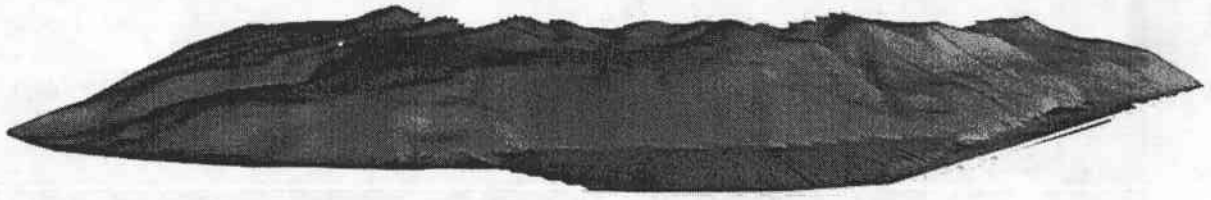
Visual Simulation, April 1997 Alternatives



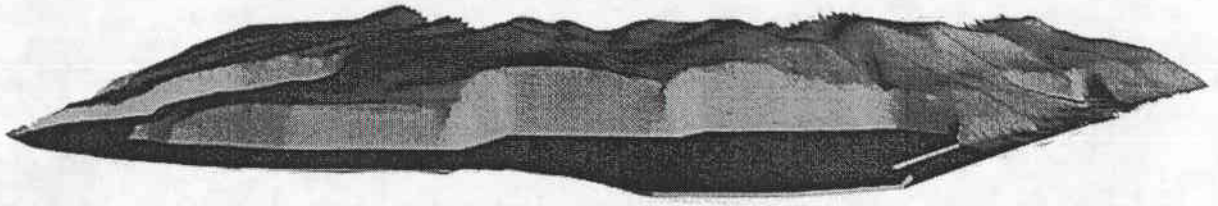
Hillside with Composite Design Alternative "A"



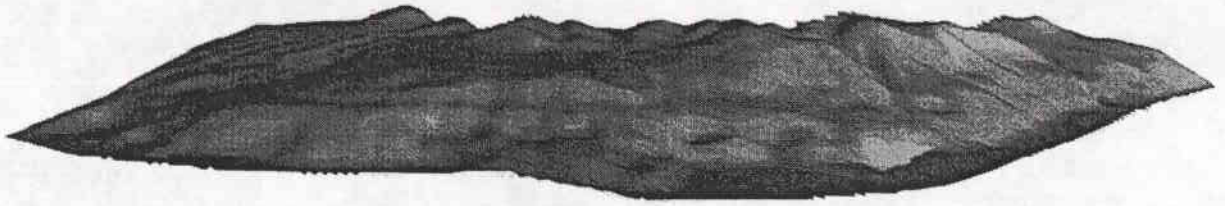
Hillside with Composite Design Alternative "B"



Hillside with Slope Permitting Revegetation



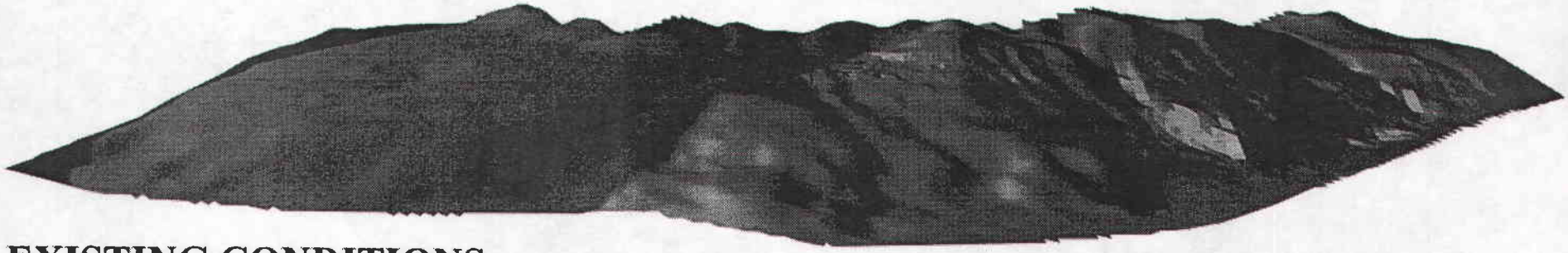
Hillside with Steepest Safe Slope



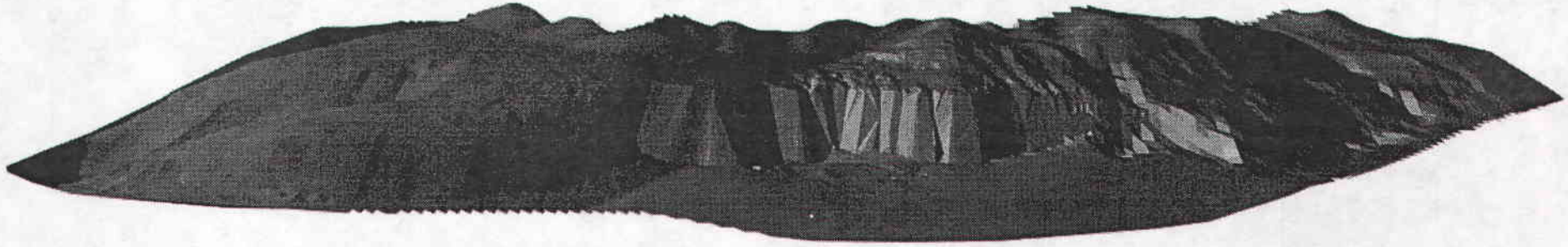
Existing Conditions

FIGURE 16

Shaded Relief Image, April, 1997 Alternatives



EXISTING CONDITIONS



HILLSIDE WITH BENCH PRESERVATION PLAN

FIGURE 17

Shaded Relief of the Bench Preservation Alternative

5.0 SUMMARY

A number of planning principles emerged after evaluating the alternative scenarios. As summarized below, these principles served as the framework for the Plan presented in Chapter Two.

5.1 NATURAL AND ENVIRONMENTAL PRINCIPLES

- The eventual establishment of self-sustaining plant communities must address factors such as very steep slopes, coarse textured soil without organic matter. Fundamental to plant community establishment is the development of a soil regime that is conducive to plant growth within the constraints of soil, slope, aspect, and available water factors.

- The selection and establishment of appropriate plant species should respond to specific factors related to soils, slope, aspect and available water.

- The only reliable sources of surface water within the project area with no attached water rights, or water rights held by companies in the project area, are springs located within the Unnamed Canyon drainage, Lime Canyon, and Hell Canyon. The use of these resources to establish vegetation is dependent on quantity and the ability to distribute it to re-vegetation areas.

- A second potential means of supplying surface water to help establish re-vegetation is to purchase uphill water rights in the vicinity.

- The unique geologic formations of the Bonneville and Provo benches are recognized in the plan.

- There are many existing and potential geologic hazards in the area that are addressed in the plan, especially as a component of implementation. These hazards include earthquakes and ground shaking, surface fault rupture, liquefaction, tectonic subsidence, seismic seiche, landslides and rockfall.

- Sixty degree excavated slopes were determined to be stable and safe.

5.2 SPATIAL AND VISUAL PRINCIPLES

- The mature, natural vegetation around the four canyons is unique and should be preserved where possible.

- The Provo and Bonneville Terraces are unique features that should be preserved to the greatest extent possible. Excavation has already removed much of the Provo

Bench in the southern and central portions of the site, while the Bonneville Terrace is largely intact.

- Warm Springs Fault is a unique geologic feature. It should be protected.

- The study area hillside is visible at various distances from the valley floor. Excavation has already modified the hillside, altering the visual impact on the surroundings. Future alterations should serve to define and improve visual impact regardless of the extent or direction of excavation.

- The Bonneville Bench provides a naturalistic setting for recreation and viewing expanses to the west. Future excavation should not disturb either of these activities.

5.3 TRANSPORTATION AND ACCESS PRINCIPLES

- The study area is located in the midst of an important transportation corridor. Future planning and development should recognize on-going changes taking place along Beck Street, Interstate 15, and other nearby roadways.

- Chicago Street is emerging as a critical Beck Street intersection. Efforts should be made to incorporate this important crossing into the plan.

- Salt Lake City unequivocally opposes any extension of Bountiful Boulevard.

- A new secondary access road located on the northern end of the study area should be accommodated in the plan, assuming that future residential uses in the City of North Salt Lake support lower-density, clustered uses.

5.4 LAND USE AND ZONING PRINCIPLES

Salt Lake City

- The preferred land use scenario supports a business park and open space in Salt Lake City.

- The development of new extractive industries in the foothills east of Beck Street in Salt Lake City should be prohibited.

- Salt Lake City opposes the expansion of extractive industries in the study area. Where excavation rights exist, the City should explore the feasibility of obtaining the rights through conservation easements, purchase of development rights, purchase of fee title or trade to insure expansion does not occur.

- Extraction activities in Salt Lake City should not conflict with the continued use of the Bonneville Bench as a recreation and viewing area.
- As existing extraction industries deplete their resources, new and appropriate uses should be identified to replace them.
- Existing industrial land uses, especially those which emit pollutants, should be encouraged to increase landscaping on their properties. The City should actively pursue landscaping improvements along the Beck Street corridor.
- Buffering should be required between different types of land uses.
- The Bonneville Shoreline Trail, Warm Springs Fault Trail and east-west trail corridors should be designated in the plan.
- A "cliff face" trail should be developed that meanders up the exposed face of bedrock between the remnants of Hell Canyon at the bottom and Lime Canyon on the Bench.
- All publicly owned land should be earmarked for open space
- The old lime kiln should be preserved as a historic structure.

North Salt Lake

- Future land use and zoning in the City of North Salt Lake should reflect the desires and goals of the community.
- The preferred land use scenario supports residential and open space in the City of North Salt Lake.
- All existing and proposed extraction operations in the City of North Salt Lake should be zoned appropriately.
- Residential and open space areas should be zoned to clearly indicate appropriate residential densities and/or the extent of open space preservation.
- Residential uses in the City of North Salt Lake should be developed according to "open space community" principles.
- All publicly owned land should be earmarked for open space

5.5 ECONOMIC PRINCIPLES

- Open Space preservation has a demonstrated value in the City of North Salt Lake and Salt Lake City. It also has a demonstrated intrinsic value.

- The needs of the excavation operators should be balanced with the desire of preserving the Bonneville Bench and other important open spaces.

- In Salt Lake City, final excavation limit line and excavation slopes should reflect the desire to preserve the bench while allowing operators a reasonable return from their endeavors. The preferred alternative excavation limit line preserves all of the flat-slope portion of the Bonneville Bench within the Hughes and Hughes and Staker properties, and provides a smooth transition to the property boundary within the Monroc property.