



Grading and Drainage

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GRADING AND DRAINAGE

Site grading and drainage are important factors in the planning, design and development of a project; as well as the implementation of community improvement and infrastructure programs. This section of the Planning and Design Guidelines Manual sets forth site grading techniques that can reduce costs, minimize environmental impacts and preserve views, natural land contours and desert landscapes and vegetation. It also addresses ways in which sites can be planned and designed to maintain natural drainage patterns, reduce storm water runoff and erosion, as well as avoid the diversion of water flows from existing drainage courses. Specifically, the following guidelines are recommended to developers of future foothill sites in order to:



- ensure that any development of the City's surrounding foothill areas is accomplished in a manner that preserves the natural terrain, protects the existing desert landscape character and has minimum visual impact on the City of Surprise.
- ensure the stability of foothill slopes;
- reduce water runoff and control erosion by maintaining the natural features of the land to reduce erosion and minimize storm water runoff;
- minimize grading and site disturbance in order to maximize compatibility with the natural terrain;
- preserve sensitive hillside environments;
- minimize the need for public services where the ability to provide such services is limited by the terrain; and
- encourage the conservation of foothill and steeper hillside areas as visual resources, parks, open space, conservation areas and other related land uses.

GRADING - *The following guidelines set forth criteria for grading land parcels so that alteration of the natural topography is minimized; and preservation of sensitive landforms, hillsides, drainage and desert landscape features is maximized.*

- Developers of sensitive foothill slopes around the City of Surprise should be required to produce a Master Grading Plan that clearly demonstrates respect and accommodation of the natural features of the site.
- Plans for grading and excavation of a site should always incorporate the recommendations of a geotechnical report that has been prepared by a registered engineer; especially as relates to stability of soils and possible seismic activity.
- Foothill areas that are determined not to be usable for building sites should be integrated into the community open space system.

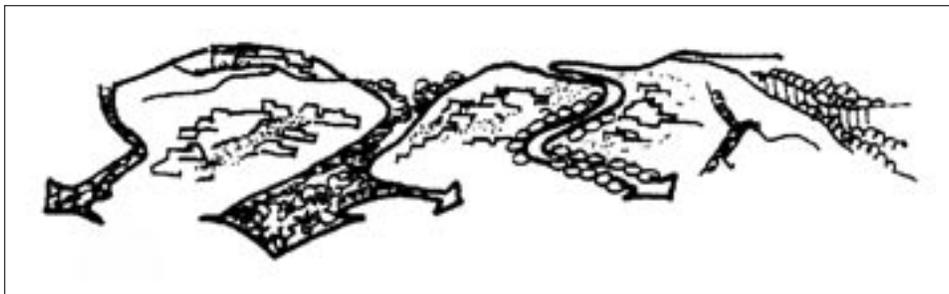
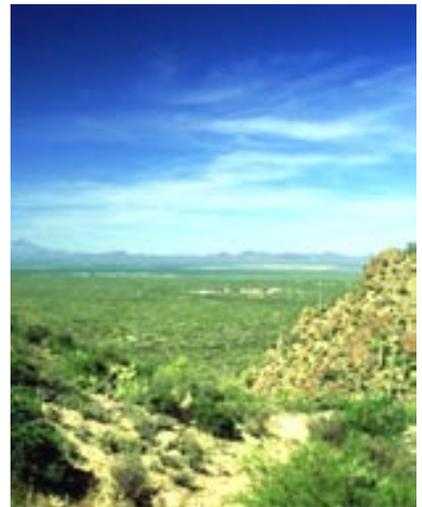


figure 9.1: Areas Unsuitable for Building Should be Incorporated into the Community Open Space

- The alteration of existing topography and drainage patterns on large tracts of foothill and steeper hillside lands should be carefully assessed to ensure protection of the existing landscape character, area wildlife and visual resource.

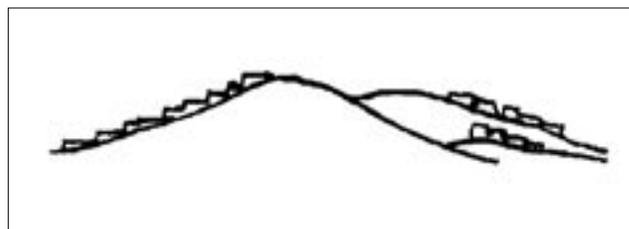


figure 9.2: Building Forms Respect Ridgelines and Valleys

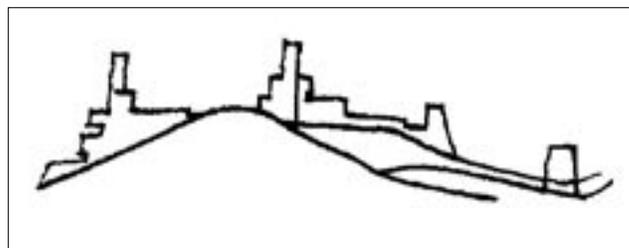
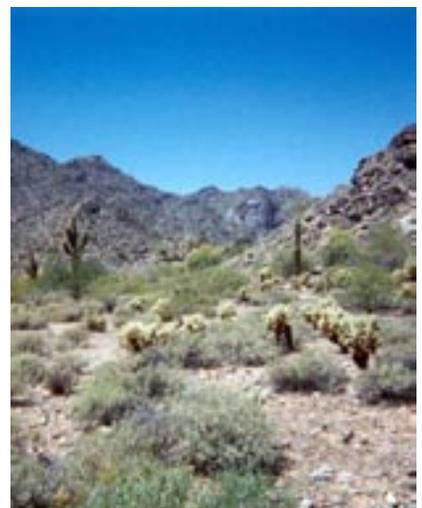


figure 9.3: Avoid Destruction of Ridgelines and Valley Forms



- Wherever possible, and particularly in those foothill areas of the City adjoining the White Tank Mountain Regional Park having a slope of four (4) percent or greater, site plans and designs should reflect a sensitive approach to development wherein roads, hiking and equestrian trails, access walkways, driveways and drainage areas conform as closely as possible with the natural contours of the site.

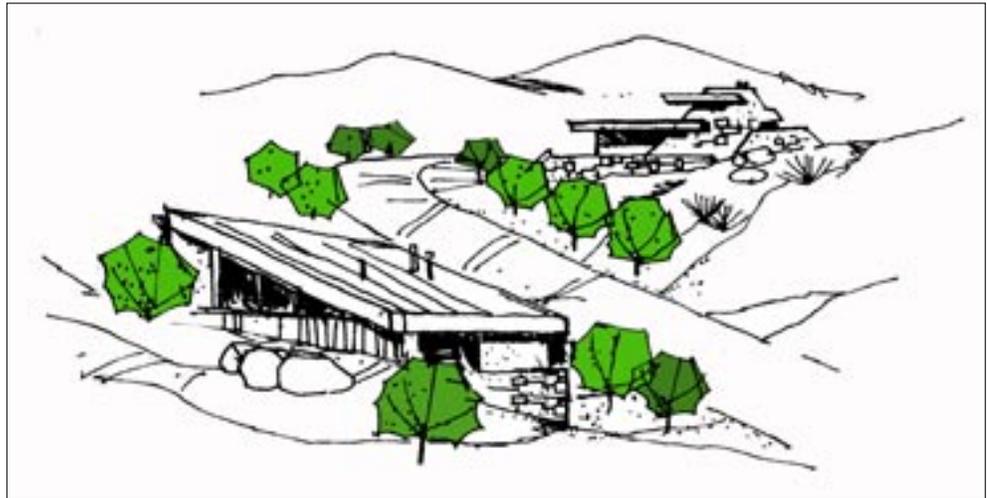


figure 9.4: Building Siting respects the Topography of the Area

- Changes in, or alteration of, the topography of a site having a slope of four (4) percent or greater should be allowed, provided the topographic changes:
 - minimize the disturbance of the natural topography and desert landscaping and vegetation;
 - recognize and preserve views to and from the site;
 - lessen the impact of the building mass of any large facilities;
 - minimize grade differences between new and existing adjacent development; and
 - limit grading to the building envelope.

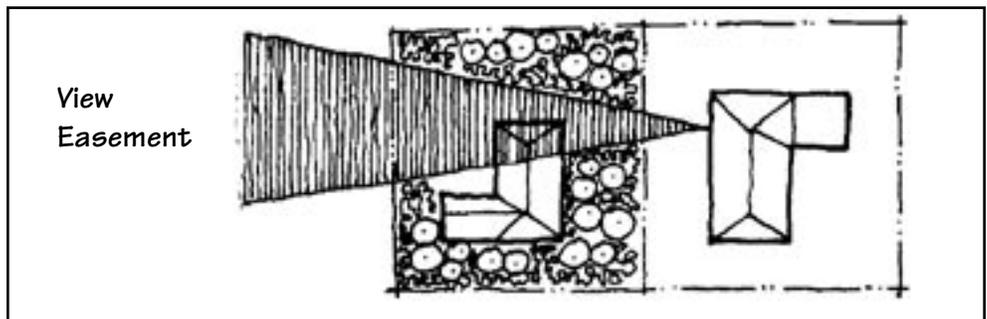


figure 9.5: Plan View of a Site Plan Preserving Views To and From Site

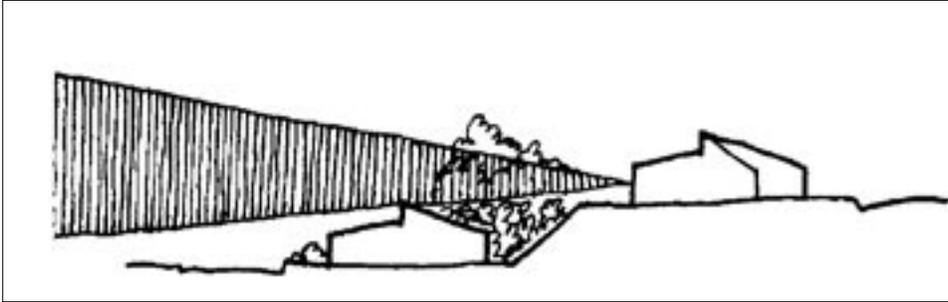


figure 9.6: Section View of a Site Plan Preserving Views To and From Site

- Site planning and design should recognize the role of topographic changes, particularly changes in site elevations, as they relate to providing functional separation and visual screening and/or buffering between improvements on the same site, or between the overall project and its neighbors.

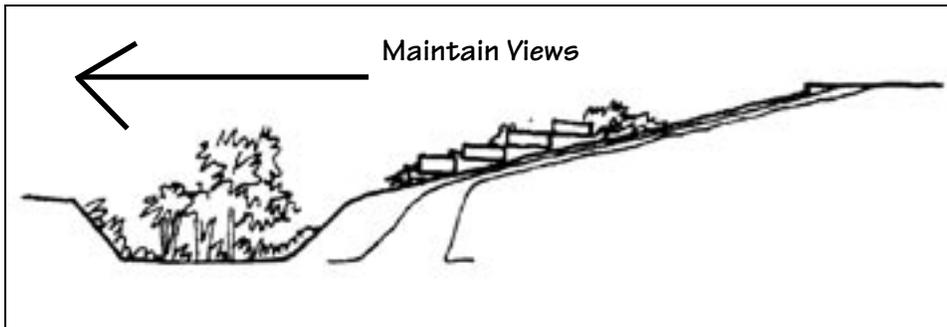


figure 9.7: Building to Take Advantage of Topography While Preserving Views and Landscape

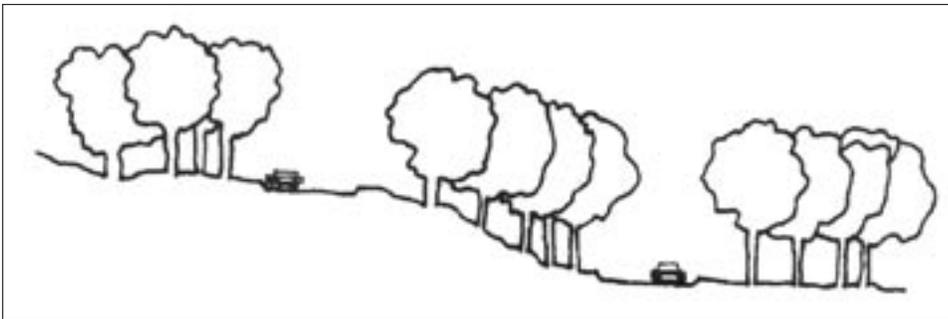
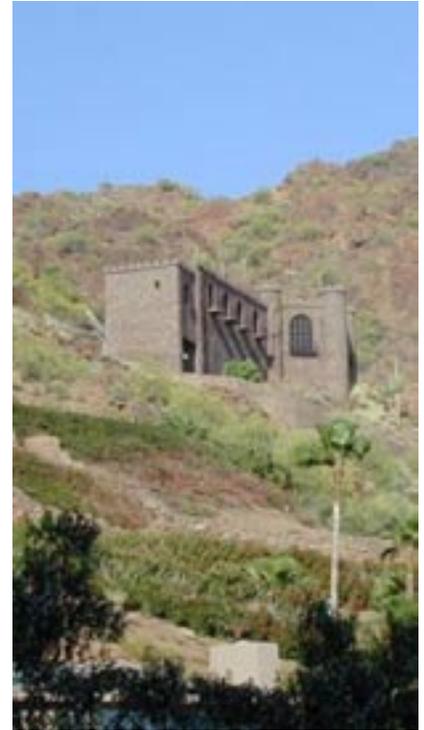


figure 9.8: Grading New Road Preserves Landscape and Topography

- All site plans and designs should utilize topographic maps that reflect the existing terrain, including: contour intervals sufficient to show the nature of, and variations in, the site terrain; elevation of critical spots; rock outcrops and special characteristics of the site. For sites having a slope of less than ten (10) percent, topographic maps should have two (2) foot contour intervals. Topographic maps for sites having a slope greater than ten (10) percent should have five (5) foot contour intervals.



- Mass grading of large land parcels should be discouraged in order to prevent damage to such sensitive and environmental aspects of the site as existing vegetative cover, washes and drainage patterns.
- The grading concept for any site should seek to balance cut and fill on the site to avoid off-site stockpiling and further damage to the natural topography
- The utilization of terracing along natural land contours and other grading techniques that respect the natural topography of the land should be encouraged in order to avoid the use of tall or prominent retaining walls, steep landscape banks and excessive cut and fill to create buildable land parcels, particularly in highly visible areas of the City's surrounding foothills.

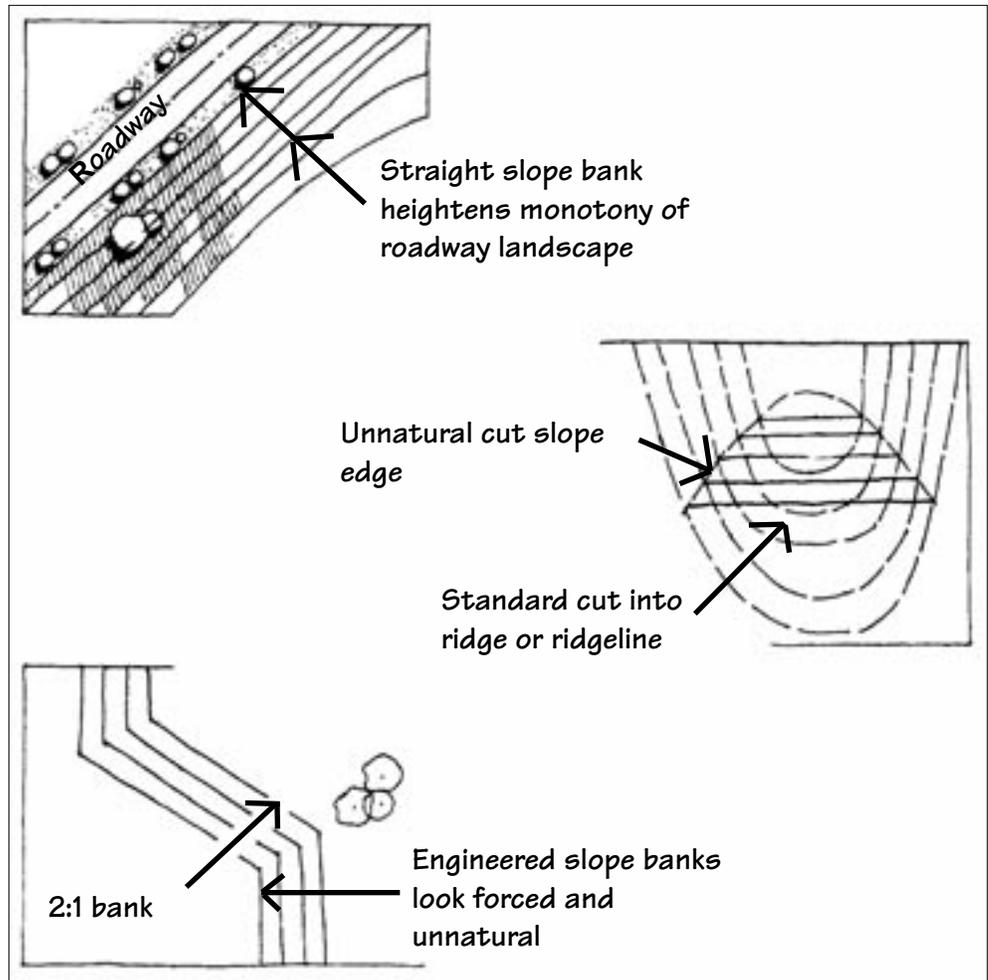


figure 9.9: Insensitive Grading Techniques Create Unnatural Appearances

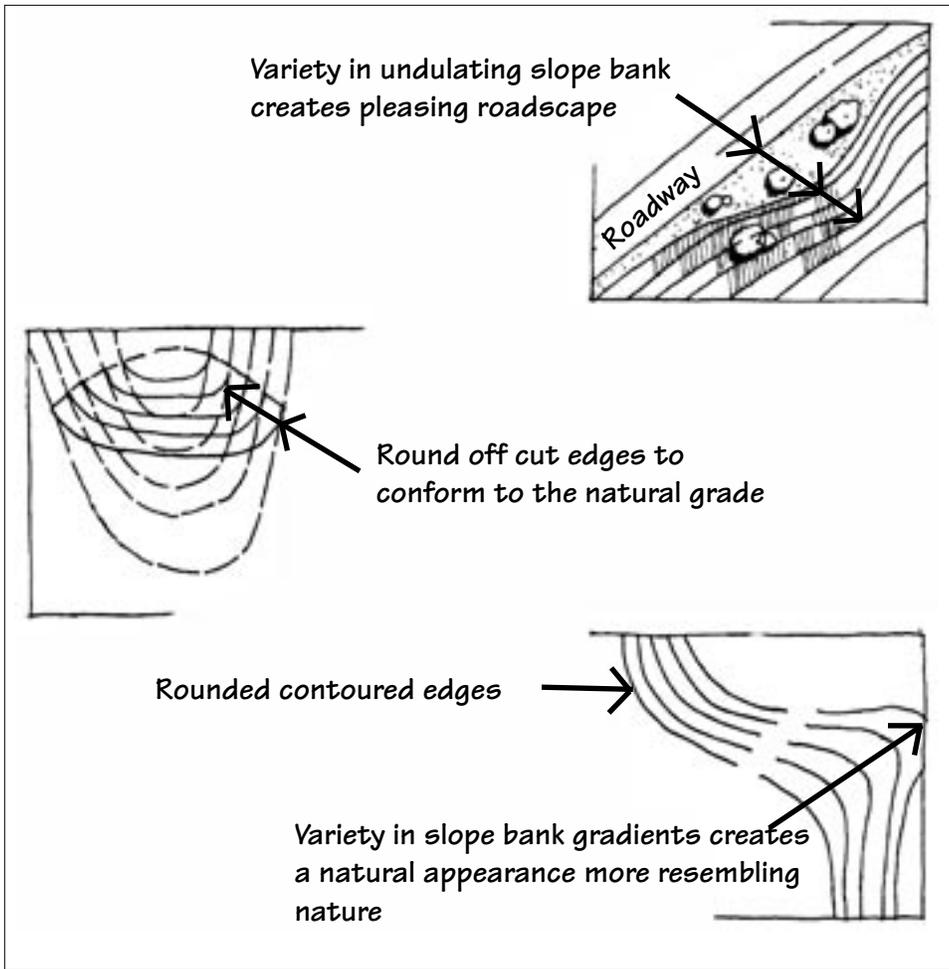


figure 9.9: Use of Grading Techniques to Preserve Natural Contours of the Land

- Where a graded building pad is allowed, the pad should extend beyond the building foundation in order to create a less abrupt natural transition to the surrounding natural setting.

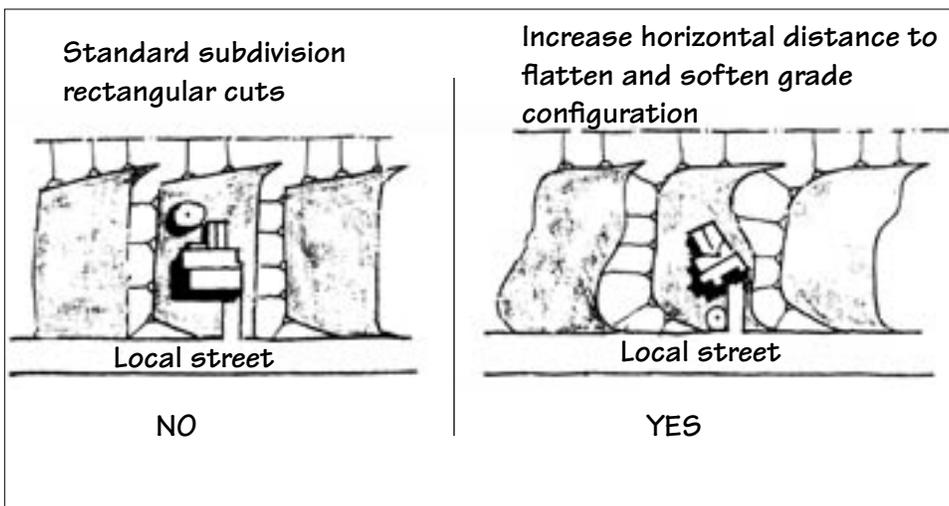


figure 9.11: Building Pads for Hillside that Minimize Disruption to the Natural Site



- Proposed grade cuts and fills in foothill and steeper hillside areas should imitate natural slope changes and be rounded off both vertically and horizontally to minimize any scarring of the land and to provide gradual transition to the toes of fills.

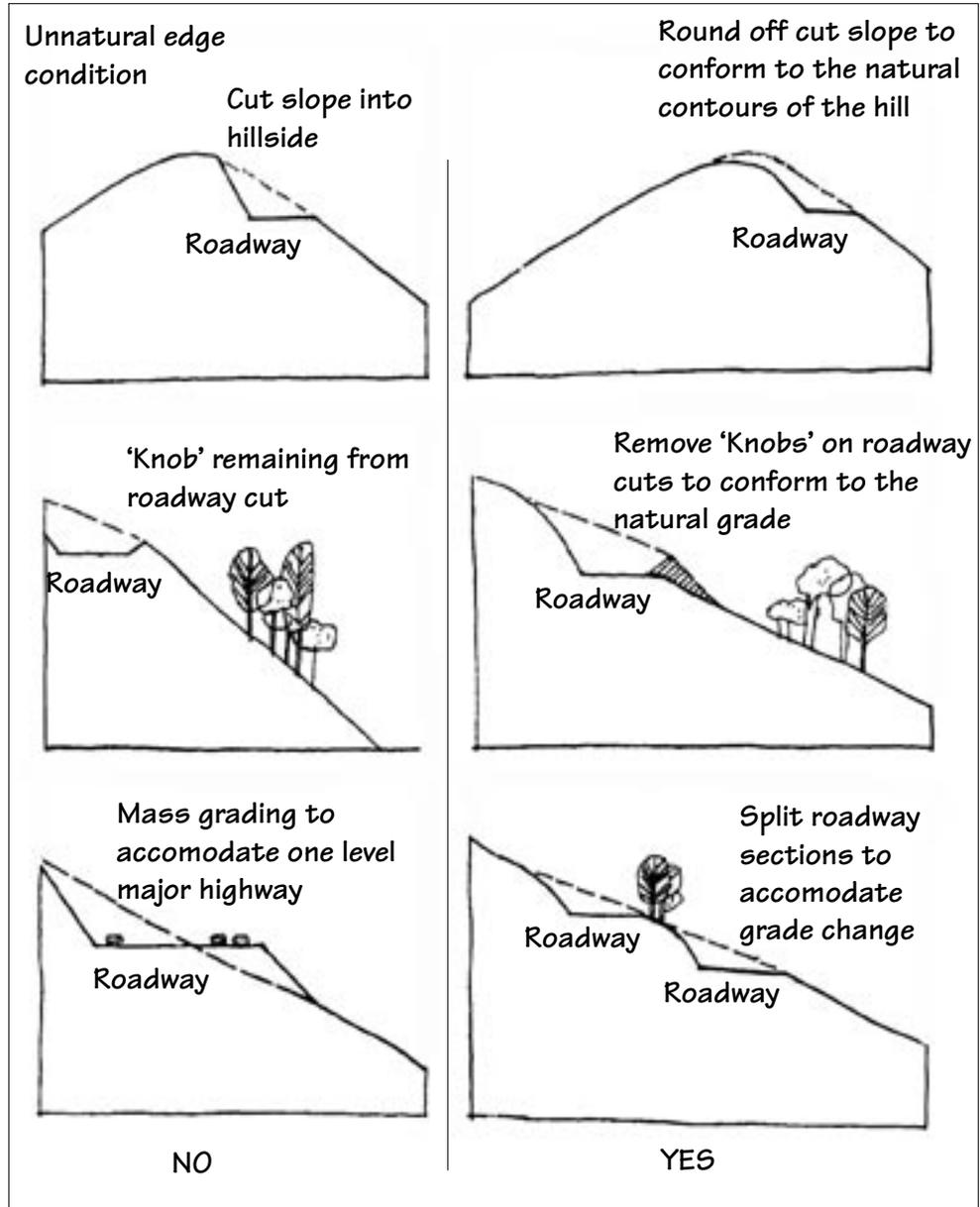


figure 9.10: Grading Techniques that Minimize Scarring of the Land

- Grading on new project sites should blend with the contours of adjacent properties.
- When grading a site located within an already developed area, every effort should be made to ensure that there is little or no impact on immediately adjacent development, including subsurface infrastructure.

- Grading plans for sites adjacent to natural open space should ensure that any grading of the developable site will have minimum impact on the sensitive natural areas.
- Newly graded slopes should be planted with appropriate erosion control plant materials.
- The visual impact of long or high slope banks should be softened by utilizing such grading techniques as terracing; varying the height of slopes; contour grading; rounding the tops and bottoms of slopes and screening with landscaping.

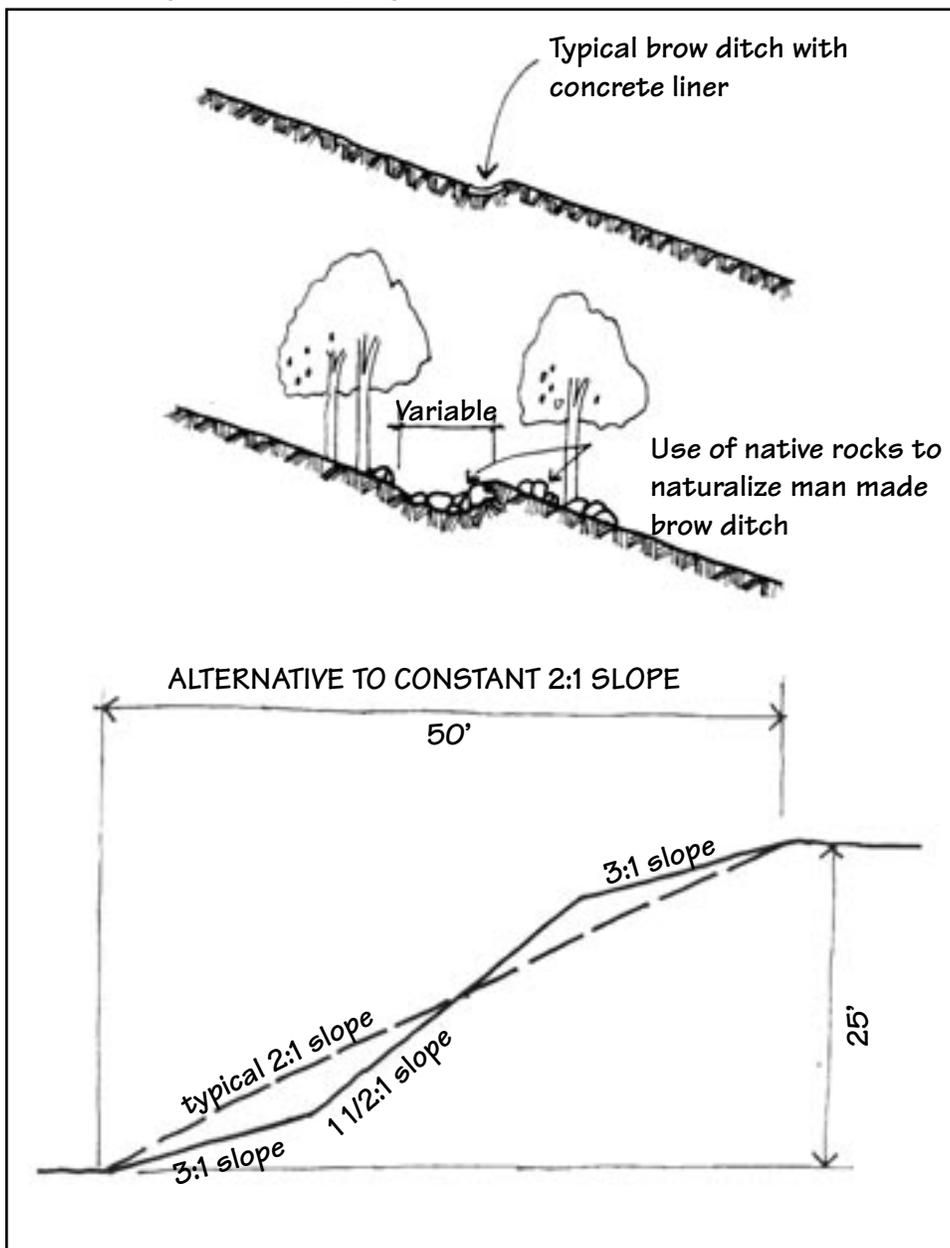


figure 9.13: Grading Techniques that Lessen Visual Impacts of Long or High Slope Banks

- Fire management and fire vehicle access should be limited to the natural open space areas of the foothills and steeper hillsides, with any associated grading minimized.
- Mature trees that exist on a site or in a right-of-way proposed for development, should always be preserved and carefully protected and maintained during grading and construction of the proposed site.
- When developing any land area within the City of Surprise the following techniques and approaches to grading, slope gradients and grading operations should be utilized.
 - Contour slopes when space permits.
 - Where retaining walls are necessary, incorporate them into other design features on the site such as stairs, ramps and planters.
 - Coordinate all grading plans with site drainage.
 - Avoid site grading which necessitates blasting.
 - Design slopes to facilitate surface drainage, limit soil erosion and avoid landslides and soil instability.
 - Avoid the use of steep slope gradients, particularly in areas where there are geologically unstable conditions, sight lines should be preserved, and landscaping is required for slope stabilization.
 - Ensure that slope gradients for such hardscape open space areas as plazas that are proposed for a site are minimized to accommodate ease of pedestrian movement.
 - Avoid soil and debris spillover and trampling of vegetation in areas adjacent to the project site when implementing grading operations.
 - For sites where large areas are to be graded, grading operations should avoid clearing the ground far in advance of site grading to limit erosion.
 - Strip and stockpile top soil for reuse, prior to grading the site.
 - Provide dust control measures during grading.
 - Include mitigation measures of any hazardous materials found existing on the site during grading operations.
 - Undertake any required mitigation measures of archeological sites as part of project grading operations.



- Provide maintenance of any pedestrian, disabled, bicycle and service access around a project site during grading and construction operations.

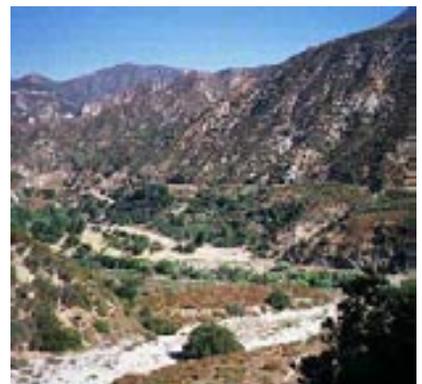
DRAINAGE - Guidelines set forth approaches to providing drainage for new development that will, where possible, maintain the natural drainage pattern of a site, avoid diversion of water flows from existing drainage courses, and minimize runoff impacts on adjacent and/or downstream areas.

- For any property to be developed, a “Master Drainage Plan” should be prepared that recognizes existing drainage and wash patterns, discharge locations and storm water flows; and clearly delineates any changes to the natural flow of water in, through and around the site.
- The planning and design of a site should recognize any floodplains, washes and other major drainage ways, and provide mitigation to avoid or control flooding.
- Natural drainage areas should be incorporated into all new developments as an environmental amenity that can enhance the open space quality and character of the community.



figure 9.14: Using Drainage Areas as a Development and Environmental Asset

- The least structural approach in providing new drainageway improvements should be used to avoid the use of concrete or other “hard edge” construction techniques for drainage channels.



- Hard surface areas such as wide streets and large paved parking lots in new developments should be reduced in order to increase ground percolation, groundwater recharge and decrease water runoff.
- All sites should be properly graded to prevent sheeting, ponding and sedimentation at building entryways and on walkways, bicycle paths and streets.
- Positive site drainage should be provided by ensuring that finish grades enable water to flow away from all buildings and structures.
- The tops and side slopes of all drainageways should be stabilized with environmentally sensitive channel and bank stabilization techniques and landscape with trees, shrubs and ground cover; and where appropriate, pedestrian and bicycle paths and equestrian trails should be provided that connect to adjacent open space and trail systems.

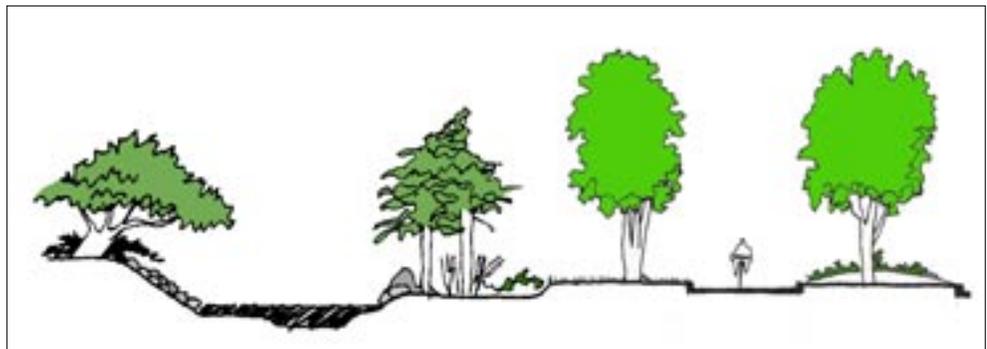


figure 9.15: Wash that is Developed as Natural Drainage Channel and Community Open Space

- Storm water harvesting and retention ponds should be provided to reduce increased storm water flows and provide opportunities to channel storm rainwater for reuse in landscaped areas of the development.
- All new development should account for any drainage flowing off-site.
- In densely developed non-residential areas where increased street, sidewalk and parking pavement generate heavy storm runoff, the use of underground storm drainage system should be considered.