



## Oak Street Basin Conceptual Design Summary Report

Prepared for:

**Flood Control District of Maricopa County**

2801 West Durango Street  
Phoenix, Arizona 85009-6399

Contract No.: FCD 2002C019  
On-Call Landscape Architectural Services  
Assignment 2

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February 2004



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## Table of Contents

<b>Project Background</b> .....	1
- Spook Hill ADMP Overview .....	1
- Oak Street Basin .....	1
- Purpose and Need of this Study .....	1
- Study Process .....	2
- Goals and Objectives.....	2
<b>Data Inventory and Analysis</b> .....	2
- Purpose of Inventory .....	2
- Hydrology .....	2
- Jurisdiction, Ownership, and Land Use.....	3
- Topography .....	3
- Visual Resources.....	4
- Ecology.....	4
- Vegetation .....	5
- Cultural Resources .....	5
<b>Opportunities and Constraints</b> .....	5
- Hydrology and Hydraulics .....	5
- Jurisdiction .....	6
- Ownership .....	6
- Land Use .....	6
- Topography/Landform .....	6
- Visual Resources.....	7
- Ecology.....	7
- Vegetation .....	7
- Cultural Resources .....	7
<b>Conceptual Alternatives</b> .....	7
- Introduction.....	7
- Alternative 1a .....	8
- Alternative 1b .....	8
- Alternative 2 .....	8
- Alternative 3 .....	9
<b>Preferred Alternative</b> .....	9
- Design Features .....	9
- Design Guidelines.....	13
- Preliminary Estimate of Construction Costs Summary .....	14

## **Figures**

Figure 1.1	Landscape Character
Figure 1.2	Key Viewpoints & Visual Character
Figure 1.3	Site Characterization
Figure 1.4	Landform
Figure 1.5	Vegetation
Figure 2.1	Alternative 1A
Figure 2.2	Alternative 1B
Figure 2.3	Alternative 2
Figure 2.4	Alternative 3
Figure 3.1	Conceptual Grading
Figure 3.2	Conceptual Grading with aerial
Figure 3.3	Conceptual Grading Plan - Perspective A
Figure 3.4	Conceptual Grading Plan - Perspective B
Figure 3.5	Conceptual Planting
Figure 3.6	Conceptual Planting with aerial
Figure 3.7	Sections
Figure 3.8	Modified Sub-Basin 385
Figure 3.9	Modified Sub-Basin 415B

## **Appendix**

Appendix A	– Preliminary Estimate of Probable Construction Costs
Appendix B	– Spook Hill Area Drainage Master Plan, Oak Street Basin Design Guidelines

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## PROJECT BACKGROUND

### Spook Hill ADMP Overview

In September 2002, the Spook Hill Area Drainage Master Plan (ADMP) was developed for the Flood Control District of Maricopa County (DISTRICT) to expand the existing Spook Hill Area Drainage Master Study (ADMS). The primary objectives of the ADMP are (1) to develop the most practical solution that addresses the flooding issues within the watershed, and (2) to mitigate the potential increase in runoff due to development and to preserve the ability of the Buckhorn-Mesa Project to provide protection to lands downstream from future 100-year flood damages. Oak Street Basin is one of the several basins identified in the ADMP to be implemented as a flood control feature for the study area.

### Oak Street Basin

Oak Street Basin has been identified as a 9.4-acre flood control detention structure located in unincorporated Maricopa County at the northwest corner of Hawes Road and Oak Street. The location of the basin was established to address the need to attenuate the peak discharge from the Oak Street and Hawes Road storm drains before entering the existing Thunder Mountain West Channel. The site is to be designed as an off-line basin with 40-acre-feet of storage volume. The diversion of storm water into the basin is accomplished through underground splitter structures, which allow more frequent flows (smaller) to pass by unimpeded while diverting less frequent (larger) flows into the basin for temporary storage. For the 100-year, 24-hour storm, the ADMP identified a bypass flow of 200 cubic feet per second (cfs) and a peak diversion into the basin of 823 cfs. In addition to the City of Mesa's *Site Development Design Standards* (Section 11-15-1 through Section 11-15-5), design guidelines were outlined in the ADMP to address the design of the Oak Street basin (reference Appendix A – Spook Hill Area Drainage Master Plan, Oak Street Basin Design Guidelines). These guidelines set initial basin design criteria and have been referenced throughout the design process. It is assumed that the City of Mesa will be the cost share and development partner for the construction and future maintenance of this project.

### Purpose and Need for this Study

The DISTRICT has a policy of developing their facilities, where feasible, on lands that avoid displacement of established development. A ten-acre vacant land parcel at the corner of Oak Street and Hawes Road was identified in the ADMP as the only vacant site available to fulfill the required flood control measures of this area. To develop the basin, the DISTRICT must acquire the site either by purchase or through condemnation. The landowner of the identified property, purchased this, and other surrounding parcels, to protect the site's character and thus provide a "Sonoran Desert" open space buffer around his residence located on the adjacent parcel to the north. The proposed development of the basin has raised concern with respect to the impact it

may have on the current owner's residence and surrounding residential properties, including aesthetic considerations.

This study has been prepared to address these concerns, as well as the DISTRICT's concerns of visual and physical impact of the basin's proposed size requirements within the limited parcel available, particularly in the sensitive setting. The design study further refines the preliminary basin design presented in the Spook Hill ADMP and explores alternative related solutions for the basin hydraulics and aesthetics. The specific study process goals and objectives pertaining to the conceptual design of the basin are further described below.

### **Study Process**

In order to develop the conceptual design for Oak Street basin, the project team first identified specific goals and objectives. The site was then inventoried and resource conditions documented. This information was analyzed and used to guide the basin design in a manner that addressed the overall goals and objectives. Several basin alternatives concepts were developed and studied evaluating the strengths and weaknesses of each design and assuring compliance with the basin's flood control requirements. A preferred alternative was then selected.

### **Goals and Objectives**

Five specific goals and objectives were identified to direct the conceptual design of the Oak Street Basin. They are to: (1) meet the flood control requirements of the basin for capacity, hydrology, and hydraulics for the 100-year, 24-hour event and as outlined by the ADMP, (2) be responsive to the existing visual character of the site, (3) preserve and enhance (to the greatest degree possible) prominent views of the site from off-site locations, (4) preserve and/or reestablish the site ecology (to the degree possible), and (5) preserve the intent of the existing open space buffer with respect to the Douglas residence and the surrounding community (to the greatest degree possible).

## **DATA INVENTORY AND ANALYSIS**

### **Purpose of Inventory**

To meet the goals and objectives of the design, an understanding of the site's existing resources was developed through an overview inventory and analysis of site hydrology, jurisdiction, ownership, surrounding land uses, topography, visual resources, ecology, dominant vegetation, and cultural resources. Following is a summary of this inventory.

### **Hydrology**

The basin parcel is significantly impacted by the offsite drainage. Drainage flows across the site from the northeast to the southwest. Two major drainages currently impact the basin site (Figure 1.3). It is estimated that 613 cfs originating from Sub-basin 385 (Figure 3.8), about a 0.5 square

mile watershed, will enter the parcel along the south boundary in a sheet flow fashion. This flow is a result of diversion along Oak Street. The majority of flow entering the site occurs from this drainage.

Additional flow is anticipated to enter the site at the northeast corner of the parcel from Sub-basin 415B (Figure 3.9) and flow through the Central Flats (a description of site units, e.g. Central Flats, is provided under the discussion on Topography below) via the Central Flats Wash (Figure 1.3). A portion of the sub-basin flow will also enter in a sheet flow fashion at the northwest corner of the parcel. Sub-basin 415B was modified from the ADMP for the flow impacting the detention basin at the northwest corner. The overall drainage area contributing from Sub-basin 415B was updated to 0.29 square miles, based on the detailed topography. A tributary of Sub-basin 415B (Northwest Wash) which flows through the Northwest Wash area also affects the northwest corner of the site. Both the Central Flats Wash and the Northwest Wash are 404 jurisdictional washes and are the primary drainages running across the site. The Central Flats Wash is the largest wash on the site and has a wide sandy bottom and flows off the site at the northwest corner, roughly dividing the site in half. The Northwest Wash enters the site at about the midpoint of the north property boundary line and exits at roughly the midpoint of the west property boundary line. It is deeply incised exposing rock/caliche and its flows continue downstream across Hawes Road. Several other smaller drainages are also located on the site.

Based on a reconnaissance level review of the existing washes and drainage patterns, a significant portion of this parcel is in a flood hazard area. The flood hazard is anticipated to follow the wash outfalls on the western boundary of this parcel.

With the recommended basin improvements, the flood hazard on the western boundary is significantly reduced. To maintain vegetation in the existing washes, some initial flows from all rainfall events will be allowed to continue in the existing washes.

### **Jurisdiction, Ownership, and Land Use**

The basin site is located within unincorporated Maricopa County in the annex area of the City of Mesa and is currently owned by Mr. Henry Douglas (Figure 1.3). Mr. Douglas purchased the property to protect the site's character, providing a "Sonoran Desert" open space buffer around his residence located on the adjacent parcel to the north. He has also considered the potential of developing one or two homes on the site for his children. While the site is privately owned and currently not accessible by the public, the Douglas' have established a walking trail on the land parcel that they use quite frequently, if not daily.

In addition to the project site, Mr. Douglas also owns the adjacent parcel to the north (on which his home is located) and an undeveloped parcel immediately northeast of the site. Additional areas surrounding the site are primarily residential, both acreage lots with custom built homes to the east and west, as well as a high end, walled community development to the south.

### **Topography**

Drainages running across the site have created a topographic pattern that is generally angular in character with sharp transitions in form. There is roughly 30 feet of fall across the site from

the northeast corner to southwest corner, producing an average slope of four to six percent on the site. Five landform areas have been characterized for the site based on topography and hydrology as follows (Figure 1.4):

*Northwest Flats* – Open level area on northwest corner of site

*Northwest Wash* – Dissected and undulating wash corridor

*Central Flats* – Flat to gentle sloping open area in the center of the site

*Eastern Drainages* – Heavily dissected area with numerous small drainages and exposed rock occurring in the wash bottoms

*Southwestern Flats* – Gently falling grade with rolling topography slightly dissected by small drainages

## **Visual Resources**

### **Landscape Setting**

The Oak Street Basin site is located within the Sonoran Desert Landscape Character Type, Mountain Lands Subtype, and Natural Bajada Landscape Unit (Suburban Bajada Landscape Unit surrounding) in Maricopa County (Figure 1.1). The Natural Bajada Landscape Unit is comprised of the characteristics of the Bajada Physical Division and those of the Natural Landscape Setting. Similarly, the Suburban Bajada Landscape Unit is comprised of the characteristics of the Bajada Physical Division and those of the Suburban Landscape Setting (FCDMC, *Preliminary Existing Landscape Character Assessment Report*, 2003)

The area in which the site is located is characterized by slightly sloping landforms that exhibit braided networks of u-shaped shallow washes and arroyos with saguaro, paloverde, and mixed cacti vegetation. Cultural modifications in the immediate site vicinity include dispersed rural and suburban residences.

### **Prominent Views**

For purposes of this study, four key views have been identified for analysis. These include: (1) views from the Douglas residence looking south/southwest towards the site including views to the site from the main residence's upper and lower decks, and the guesthouse; (2) views from the intersection of Hawes Road and Oak Street looking northwest toward Usery Mountain with the project site in the foreground; (3) elevated views onto the site looking west from an adjacent residence; and (4) views from a walking trail located on the parcel northeast of the project site (Figures 1.2 and 1.3). Additionally, due to the topography of the area, views onto the site are prominent from residents on upper Oak Street on the approach to Hawes Road.

## **Ecology**

The ecology of the site is classified as Sonoran Desert Biome, Arizona Upland Subdivision, Sonoran Paloverde Mixed Cacti, Mixed Shrub Community – Xeroriparian Desert Habitat (Figure 1.3). In general these areas may provide suitable habitat for noted species including cactus ferruginous pygmy-owl, lesser long-nosed bat, Sonoran desert tortoise, and American peregrine

falcon. Prominent species observed on the site have included Grey or Great horned owl (with a nest in saguaro located on site – Figure 1.2), Harris hawk, and turkey vultures.

### **Vegetation**

Dominant vegetation species on site include saguaro, paloverde, ironwood, creosote, bursage, cholla cacti, and ocotillo. Saguaros are dispersed fairly evenly across the site. Large trees (primarily paloverde and ironwood) and dense groupings of large shrubs grow in linear patterns across the site following the undulations in the topography and drainages. Figure 1.5 illustrates the locations of saguaros, large trees, and groupings of large shrubs. Additionally, Figure 1.5 delineates the primary and secondary significant vegetation stands to remain undisturbed to the extent possible including: the established nesting Saguaro, groupings of shrubs and cacti at the north boundary of the site which buffer views from the property owner's residence to the north, and tree, shrub, and cacti vegetation located in washes.

### **Cultural Resources**

The ADMP includes a cultural study based on results of an archaeological inventory and site records review from various federal, state, and local agencies. In this regard, the study identifies several Hohokam archaeological sites and numerous historic sites located in the Spook Hill study area; however none have been identified on the Oak Street Basin site proper (Figure 1.3).

## **OPPORTUNITIES AND CONSTRAINTS**

To meet the goals and objectives for the Oak Street Basin, it was critical that the design be responsive to the site resources previously described. Understanding and responding to the hydrology, topography, ecology, and visual character of the site assists in the development of a concept that meets flood control requirements and is responsive to the aesthetic and ecological characteristics of the site to the greatest degree possible. Specifically, the consideration of these resources has assisted in the design of the:

- basin hydrology and configuration
- elements to control site lines and views
- shape of landforms
- density and layout of landscape revegetation

Following is a description of considerations and recommendations to address the resources previously described in the design of the basin.

### **Hydrology and Hydraulics**

With the creation of a basin, drainage patterns within a site are inevitably disrupted. Despite this, the intent of the basin design is to maintain the site's existing hydrology to the greatest extent possible. Proposed drainage flows and patterns should be modeled after, and complement the existing patterns of the site. When possible, preservation of drainages is

preferred, especially in the case of the Central Flats Wash and Northwest Wash (See Figures 1.3 and 1.4). Additionally, flow from the Northwest Wash needs to continue downstream across Hawes Road. Where needed, flow from surrounding washes should be collected and redirected around the basin through gentle grade modifications mimicking the existing landforms. Furthermore, the basin must be designed as an off-line facility and accommodate/meet the following criteria:

- Design Storm Event: 100-year, 24-hour
- Total flow from watershed: 1,009 cfs
- Total Inflow (diversion) into basin: 815 cfs
- Total Bypass Flow: 194 cfs
- Peak Storage Volume: 36 acre feet
- Basin Total Volume: 48 acre feet
- Basin Drain Time: less than 36 hours

### **Jurisdiction**

The site is located within the jurisdiction of Maricopa County. All pertinent zoning and ordinance requirements will be followed. Because the development of the basin will likely be a joint effort between the DISTRICT and the City of Mesa, the City of Mesa's *Uplands Development Standards* (Ordinance 3693) should also be followed.

### **Ownership**

In order for the DISTRICT to purchase the necessary parcel, reaching a mutually acceptable agreement with the current landowner (Mr. Douglas) was desired. The District considered and shared the current owner's interest that the site's natural character be preserved. This concern was heightened because of the proximity of residences to the basin site, specifically with regard to preservation of the Northwest Flats and Northwest Wash (Figure 1.4). Additionally, to minimize the physical impact to the parcel, the layout and design of the basin avoided, where possible, development and disturbance in the Northwest Flats and Northwest Wash areas.

### **Land Use**

The design of the basin is responsive to existing use. The basin is currently used as private open space by the landowner and serves as a natural visual open space for the community. The basin is designed so that effects to its natural open space character are minimized and the function and quality of a visual open space is retained.

### **Topography/Landform**

Maintaining the existing undulating and angular character of the site's topography and landform is important. This can be achieved most readily through minimizing disturbance areas and utilizing grading practices that emulate existing landform patterns where possible.

## Visual Resources

The visual character of the site can best be maintained by designing the basin in a manner that considers the landform, hydrology, and vegetative characteristics of the site and the Bajada landscape. Protecting and enhancing key views, where possible, to the site is important. Views should be enhanced through the design of landform and vegetation to screen undesirable elements such as rooftops and structures and frame focal points such as significant on-site vegetation or distant views such as that of Usery Mountain.

## Ecology

The ecology of the site should be maintained, to the degree possible, through preservation and restoration of the existing habitats and avoiding disturbance of significant vegetation as much as possible, including, most recognizably, the saguaro with the nest located in the Central Flats area of the site. Reestablishment of habitats disturbed by construction also helps facilitate the continuance of a healthy ecological site.

Circulation of wildlife is also an important consideration in protecting wildlife both during construction as well as once construction is completed. Fencing should allow wildlife to pass to and from the site. A three or four stranded barbed wire fence with the bottom one or two strands being unbarbed is recommended. Also, major excavations (trenches) that present hazards should be covered.

## Vegetation

It is important to preserve existing vegetation where possible to maintain the character of the site. The existing vegetation on site responds directly to the landform of the site, creating strong linear patterns across the site. Reintroduced planting should be developed such that it is consistent with, or emulates the existing vegetation in density, location, pattern, and type to the greatest degree possible.

## Cultural Resources

The cultural resources identified in the ADMP are not associated with the Oak Street Basin site, and therefore consideration of cultural resources was not addressed in detail in this study. Should cultural resources be identified on the site, their treatment and consideration should be integrated into the final design of the basin.

## **CONCEPTUAL ALTERNATIVES**

### Introduction

Four conceptual alternatives were initially developed for the basin (Figures 2.1, 2.2, 2.3, and 2.4) that presents potential options in the basin's size, hydrology and hydraulics, and form. All of these alternatives were designed as off-line basins. Each alternative specifies the proposed

elevation and area at the top of the freeboard ("Top of Basin"); the proposed elevation and area at the bottom of the basin ("Bottom of Basin"); the average area, depth, and volume of the alternative; and the potential contouring required to transition from the "Top of Basin" to natural grade.

Consistent to each alternative, a majority of off-site flow from Sub-basin 385 (Figure 3.8) will be intercepted by a pipe along Oak Street and a gunite V-ditch running along the eastern property through which it is conveyed to a diversion structure located at the southeast corner of the site. The diversion structure allows initial bypass flows to continue past the basin through a pipe that discharges into the existing drainage channel at the intersection of Hawes Road and Oak Street. Overflow will be directed through a pipe into the detention basin.

Flows from Sub-basin 415B (Figure 3.9) are intercepted, either through the existing washes or through a proposed channel, and directed into a diversion structure roughly located where the Northwest Wash crosses the west property boundary. Initial flows are allowed to bypass the basin and continue downstream into the existing wash. Overflow will be directed through a pipe into the basin.

Each alternative considered different methods of handling the flows from Sub-basin 415B, minimizing impacts to the northwest corner of the site and the Northwest Wash, and utilizing berming to impound storm water at the southwest corner of the basin. Following is a description of each of the alternatives. Alternative 3 was selected as the preferred alternative.

### **Alternative 1a**

Alternative 1a (Figure 2.1) is based on the design proposed in the ADMP. It is designed such that flow from the Central Flats Wash is split into two channels, directing it around the basin into each of the diversion structures. The Northwest Wash is completely preserved along with the Northwest Flats and the southwest corner of the Southwest Flats. Additionally, the basin is designed such that the "Top of Basin" ties into the existing grade at the southwest corner of the site. The resulting basin has an average area of 160,834 square feet (sf) with 4:1 slopes on the east side, a water level elevation of 1,810.25 feet, a depth of 12.5 feet, and a volume of 74,460 cubic yards (including freeboard).

### **Alternative 1b**

Alternative 1b (Figure 2.2) is similar to Alternative 1a; however, it has been designed to maximize storage volume. The basin has been shifted to the southwest with a six-foot berm added to impound storm water. The resulting basin has a larger average area (171,390 sf.), greater undulation in the basin form, and a larger volume (92,043 including freeboard). The "Top of Basin" elevation is still at 1,810.25 feet, with a basin depth of 12.5 feet.

### **Alternative 2**

Similar to Alternative 1b, Alternative 2 (Figure 2.3) also incorporates a berm to impound storm water and flow from the Central Flats Wash is split into two channels, directing it around the

basin into each of the diversion structures. However, this alternative has been designed to minimize disturbance while maximizing the volume of the basin. Additionally, flow from the Central Flats Wash being diverted to the west is directed along the northern edge of the "Top of Basin." Although the average area has been reduced to 143,993 sf., the "Top of Basin" elevation has been raised to 1,816.25 feet, increasing the depth to 17.5 feet (including freeboard) and the basin volume to 93,290 cubic yards. The reduction in area allows the Northwest Flats, Northwest Wash, portions of the Central Flats adjacent to the Douglas residence, and the southeastern corner of the Eastern Drainages to be preserved. Slopes remain roughly at 4:1 but have greater undulation, resulting in a basin form that better responds to the existing landform characteristics.

### **Alternative 3**

Alternative 3 (Figure 2.4) is similar to Alternative 2; however, the average area of the basin has been further reduced to 123,609 sf. resulting in a volume of 80,117 cubic yards, further limiting disturbance of the site and allowing the slopes to undulate more as well as be softened. Specifically, the Central Flats and Northwest Wash areas adjacent to the Douglas residence have been further preserved.

Through a review of each of the four alternatives, Alternative 3 was selected for to be further refined into the preferred alternative because it:

- meets the flood control and hydrological requirements for the basin
- eliminates the requirements for a diversion channel along the north side of the property
- provides the greatest opportunity for the form of the basin to respond to the existing topography and landforms of the site
- minimizes disturbance of the site, best preserving the site's ecology, vegetation, and views
- provides the greatest opportunity for enhancing views, both from the remaining Douglas property as well as from the intersection of Oak Street and Hawes Road through the incorporation of the impoundment berm
- limits the potential need for land take

## **PREFERRED ALTERNATIVE**

### **Design Features**

The preferred basin alternative is a refinement of Conceptual Alternative 3. This solution best addresses project goals and objectives, results from the resource inventory and analysis, and overall aesthetic and engineering requirements for the project. Following is an overview description of the Preferred Alternative and a summary of how this alternative addresses and incorporates key resource considerations.

### **Overview**

The Preferred Alternative (Figures 3.1-3.7) is designed as an off-line basin intercepting off-site flow from Sub-basin 385 (Figure 3.8) and Sub-basin 415B (Figure 3.9) prior to it entering the

basin. A pipe along Oak Street intercepts sub-basin 385 flows and a three-foot deep V-ditch running along a portion of the eastern property conveys the flows to a diversion structure located at the southeast corner of the site at Oak Street. This Oak Street diversion structure allows initial bypass flows to continue past the basin through a pipe that discharges into the existing drainage channel at the intersection of Hawes Road and Oak Street. The overflow will be directed through a pipe into the detention basin.

A four-foot berm created along an existing ridgeline located in the Central Flats on the northeast corner of the site diverts the flow from Sub-basin 415B into the Northwest Wash, preventing it from entering the basin directly. A bypass structure located where the Northwest Wash crosses the west property boundary at Hawes Road captures these flows. A V-ditch running from the northwest corner of the site to the bypass structure captures any additional flows from Sub-basin 415 not entering the Northern Wash, redirecting them into the Hawes Road bypass structure. This structure allows initial flows to continue downstream. Overflow will be directed through a pipe into the basin.

A berm, located on the southwest corner of the Southwestern Flats, together with the excavated portion of the basin, impounds storm water entering the basin. A pipe running from the southwest corner of the basin to the existing drainage channel at the intersection of Hawes Road and Oak Street allows the basin to drain once peak storm volumes have passed.

### **Hydrology/Hydraulics**

The 100-year, 24-hour HEC-1 model (recommended alternatives) from the Spook Hill ADMP Update (September 2002) was modified for the purpose of the Oak Street Basin concept refinement. The basin is conceptually designed as an off-line facility. It is designed such that it is excavated partially below the natural grades and it has an eight-foot-high berm to impound storm water runoff. The berm is considered to be of a non-jurisdictional status by the Arizona Department of Water Resources (ADWR). The basin will collect off-line flow from two sub-basins—sub-basins 385 and 415B, respectively.

#### Detention Basin Design Parameters:

- Design Storm Event: 100-year, 24-hour
- Basin Type: Off-line
- Total flow from watershed: 1,009 cfs
- Total Inflow (diversion) into basin: 815 cfs
- Total Bypass Flow: 194 cfs
  
- Peak Storage Volume: 36 acre feet
- Basin Total Volume: 48 acre feet
  
- Basin Minimum Depth: 18 feet
- Flood Depth: 15 feet
- Basin Freeboard: 3 feet
  
- Basin Bottom Elevation: 1,798.00 feet
- Basin High Water Elevation: 1,813.00 feet
- Basin Top of Bank Elevation: 1,816.00 feet

- Basin Out-flow: 20 cfs via 24-inch pipe
- Basin Drain Time: less than 36 hours

#### Basin Functioning:

Flow from the Sub-basin 385 (Figure 3.8) with about .5-square-mile watershed enters the detention basin at the southeast corner. A small tributary on the east side of the basin is intercepted by a gunite V-ditch. The ditch collects approximately 50 cfs along the eastern edge of the basin. The ditch is anticipated to be 3 feet deep with 2:1 side slopes. A majority of off-site flow will be intercepted by an 84-inch pipe along Oak Street and conveyed to the diversion structure. The diversion from this sub-basin into the detention basin will be handled by a 44-foot-long weir with 48-inch pipe, continuing past the basin to convey about 150 cfs of bypass flow. Two 60-inch RCPs were modeled to take weir overflow into the basin. The total flow from Sub-basin 385 is estimated to be 613 cfs. A total of 470 cfs is diverted into the basin and 143 cfs bypasses via a 48-inch pipe along the south border of the basin.

Sub-basin 415B (Figure 3.9) was modified for the flow impacting the detention basin at the northwest corner. The overall drainage area contributing from Sub-basin 415B was updated to 0.29 square mile, based on the detailed topography. A gunite channel collects approximately 200 cfs of the total flow from a local tributary north of the basin and directs it southerly along Hawes Road into the diversion structure. The channel is conceptually designed to be 2 feet deep with an 8-foot bottom and 2:1 side slopes. The overflow diversion of Sub-basin 415B will be handled by two 54-inch CMPs flowing into the detention basin and a 4-foot by 4-foot orifice metering flow by passing the basin. The total flow in Sub-basin 415B is 396 cfs. A total of 345 cfs is diverted into the basin and 51 cfs is allowed to bypass. The bypass flow will continue westerly across Hawes Road into a natural wash corridor (Section 404 wash).

An ungated 24-inch pipe outlet will release the impounded flow. The outfall (20cfs + 147cfs=167 cfs) from the 24-inch and 48-inch pipes respectively will be into the existing concrete channel on the east side of Hawes Road south of Oak Street. To have a positive outfall into the channel, 360 LF of 60-inch RCP will be required in Hawes Road. (Or as an option, redesigning about 360 LF of the existing channel to provide gravity out-fall for the basin).

#### **Jurisdiction and Ownership**

The preferred basin design meets DISTRICT standards and concerns for preserving the Northwest Flats and the Northwest Wash areas. Additionally, portions of the Central Flats and Eastern Drainages are preserved. With concern also expressed that the basin maintains the natural character of the site, the conceptual grading is modeled to emulate the existing landform patterns in this regard.

#### **Land Uses**

Although the basin no longer functions as private open space, it will continue to serve as natural visual open space for the immediate surrounding community.

## **Topography/Landform**

Construction of the basin requires a substantial alteration to the terrain. However, the preferred alternative has been designed in a manner that attempts to emulate the topographic patterns of the site as possible (Figures 3.1 to 3.4). The proposed contours for the basin follow the undulating and angular character of the existing topography and drainages continuing their form into the basin. Existing drainage patterns are therefore maintained to the greatest extent possible and new landform patterns modeled after the existing.

## **Vegetation**

Vegetation has been preserved, to the extent possible, within the Northwest Flats, Northwest Wash, and portions of the Central Flats and Eastern Drainages, including the large saguaro with the nest (Figure 1.2). The layout of the proposed vegetation (Figures 3.5 and 3.6) is designed to mimic existing vegetative patterns and densities. Plant material has been located to correspond with the depressions created through proposed grading establishing strong linear patterns across the site that resemble the original vegetation. Furthermore, the proposed plant material is consistent with the material found on the site (Figure 1.5). The trees and cacti on the site that cannot remain in place are to be, to the extent possible, salvaged and replanted on the site.

## **Visual Resources**

Designing the hydrology and hydraulics, topography and landform, and vegetation to emulate the natural conditions of the site, as described above, was the first step in assuring that the design for the basin be as consistent as possible with the characteristics of the Natural Bajada Landscape Setting. Furthermore, each of the prominent views has been studied to assure they are protected, and if feasible, enhanced through the new design (Figure 3.7). Specifically, views from the Douglas residence and the north focus on undisturbed vegetation and landforms in the foreground with revegetated areas and mounds in the mid-ground. The establishment of the berm impounding the storm water at the southwest corner of the basin with vegetation planting on it also helps to screen undesirable views of rooftops and other non-natural elements in the distance.

The landform and vegetation on the impoundment berm frames Usery Mountain in the background while screening the home located on the parcel immediately east of the site from the view at the corner of Hawes Road and Oak Street. Additionally, the height of the berm and the placement of vegetation at the southwest corner of the site have been limited so as not to block views of natural features and Usery Mountain. Finally, cut and fill areas are varied in their slopes and are planted so that views from the adjacent parcels focus on natural appearing areas.

## **Ecology**

Preserving the Northwest Flats, Northwest Wash, and parts of the Central Flats and Eastern Drainages leaves much of the site undisturbed. In areas where disturbance is unavoidable, attention to modified landform and reclaimed/newly planted vegetation allows the reestablishment of similar habitats.

## Design Guidelines

Design guidelines were prepared for Oak Street Basin in the Spook Hill Area Drainage Master Plan and have been included in this report as Appendix B. These design guidelines are valid and should be followed in the development of the final design of Oak Street Basin with the following two exceptions:

- (1) The conceptual design does not provide a 30 to 50 foot landscape buffer as directed in Item 1a which state, "Provide a 30-50 foot landscaped buffer zone around the basin that includes the operation and maintenance road." The basin is located in the southwest corner of the site to minimize cut on the northeast side of the site.
- (2) Item 2b states to "warp and vary side slope ratios from 3:1 to 8:1 and round top of side slopes." Side slope have been designed to have a maximum 4:1 ratio rather than a maximum 3:1 ratio.

With these two exceptions, the following design guidelines are to be followed in addition to the design guidelines identified for Oak Street Basin in the Spook Hill Area Drainage Master Plan.

### **Hydrology and Hydraulics**

- Preserve the Northwest 404 wash corridor
- Maintain existing hydrology to greatest extent possible
- Maintain existing drainage patterns to greatest extent possible
- Maintain existing flows off-site
- Utilize gentle grade modifications to collect flow from surrounding washes and redirect flow around the basin
- Minimize the size of V-ditches and structures
- Provide aesthetic treatment to any exposed structures (rock facing, coloration, concrete liners, etc.) to tie structure into natural setting

### **Topography and Landform**

- Minimize disturbance of the site
- Model grading to emulate the angularity and transitions of the existing landform patterns
- Identify drainage patterns of the site and continue them into the form of the basin
- Vary the basin side slope ratio from 4:1 to 8:1, creating irregular basin sides that follow the existing topography of the site
- Vary the landform in the bottom of the basin, creating undulations in the floor consistent with the natural topography

### **Vegetation**

- Preserve existing vegetation where possible, specifically avoiding saguaros and mature ironwoods
- Develop planting plan that is consistent to existing vegetation in density, location, growth patterns, and plant materials

- Design revegetation to correspond directly to the landform, specifically following depressions and channels thereby creating strong linear patterns across site
- Select plant material that is consistent with the existing material indigenous to the site
- Install temporary irrigation system to establish container planted material
- Salvage and re-establish indigenous vegetation wherever possible
- Specifically consider views from the Douglas Residence, surrounding residences, and the corner of Oak Street and Hawes Road in placement of plant material
- Salvage surface soil (6-8 inches) from the basin area and replace it in the landscaped areas (maximum stockpile height for surface soil shall not exceed 8 feet)

#### Views

- Maintain the Natural Bajada Landscape Unit character of the site through grading, hydrology, revegetation and reclamation
- Preserve and enhance, where possible, identified prominent views as designated in the analysis (Figure 1.3); this includes views from Douglas Residence to site, from the corner of Hawes Road and Oak Street to Usery Mountain, from adjacent residences to site, and from existing trail to the site

#### Ecology

- Minimize disturbance of the site including prominent saguaros and trees
- Preserve specific habitats of notes species (where feasible) such as the nest in the Saguaro located in the Central Flats area of the site
- Reestablish habitats disturbed by the construction of basin

#### Preliminary Estimate of Construction Costs Summary

A Preliminary Estimate of Probable Construction Costs has been prepared for the Conceptual Preferred Alternative and is located in Appendix A. The following is a summary of the Estimate of Probable Construction Costs:

<b>Construction</b>	
Removals	\$ 22,498.75
Earthwork	\$ 324,180.00
Structures and Paving	\$ 337,197.96
Landscape	\$ 257,545.84
Construction Subtotal	\$ 941,422.55
Construction Contingencies (25%)	\$ 235,355.64
<b>Construction Total</b>	<b>\$ 1,176,778.19</b>
<b>Design/Engineering/CA</b>	
Engineering (10%)	\$ 117,677.82
Construction Administration (6%)	\$ 70,606.69
<b>Design/Engineering/CA Subtotal</b>	<b>\$ 188,284.51</b>
<b>TOTAL</b>	<b>\$ 1,365,062.70</b>

**APPENDIX - A**

**Oak Street Basin**

**Estimate of Probable Construction Costs\***

Prepared by: EPG, Inc.

Date: February, 2004

\*Based on concept level work only

Item	Quantity	Unit Cost	Sub-Total
<b>Removals</b>			
- Removal of existing fence	1,914 lf	\$1.50	\$2,871.00
- Salvage - Existing Saguaros	12 ea	\$455.00	\$5,460.00
- Salvage - Existing Trees	19 ea	\$627.25	\$11,917.75
- Remove - Existing Trees	15 ea	\$150.00	\$2,250.00
<b>- Removal Sub-Total</b>			<b>\$22,498.75</b>

<b>Earthwork</b>			
- Channel Excavation	420 cy	\$4.00	\$1,680.00
- Basin Excavation and Disposal	75,000 cy	\$4.00	\$300,000.00
- Basin Excavation and Fill	9,000 cy	\$2.50	\$22,500.00
<b>- Earthwork Sub-Total</b>			<b>\$324,180.00</b>

<b>Structures and Paving</b>			
- 24" CMP	200 lf	\$56.00	\$11,200.00
- 48" CMP	450 lf	\$119.00	\$53,550.00
- 54" CMP	240 lf	\$142.00	\$34,080.00
- 60" RCP	630 lf	\$155.00	\$97,650.00
- Manhole	2 ea	\$6,000.00	\$12,000.00
- Inlet Channel (Gunitite)	600 sy	\$32.50	\$19,500.00
- Diversion Structure	52 cy	\$300.00	\$15,600.00
- Inlet Headwall for 24" outfall	1 ea	\$4,000.00	\$4,000.00
- Drop Inlet Headwall at NW	1 ea	\$6,000.00	\$6,000.00
- Outlet Headwalls at NE & SE	2 ea	\$4,000.00	\$8,000.00
- Diversion Channel (Gunitite)	300 sy	\$32.50	\$9,750.00
- Diversion Wall at NW (reinforced concrete)	6 cy	\$300.00	\$1,800.00
- Rip Rap outlet aprons	60 cy	\$40.00	\$2,400.00
- ABC Paving for Maintenance Road	4,249 sf	\$1.00	\$4,249.00
- 4 Strand Fence and Gates	2,408 lf	\$3.50	\$8,428.00
- Aesthetic Treatment to Structures	1 ls	\$48,990.96	\$48,990.96
<b>- Structures Sub-Total</b>			<b>\$337,197.96</b>

<b>Landscape</b>			
- Fine Grading	330,340 sf	\$0.20	\$66,068.00
- Replant Salvaged Saguaros	12 ea	\$455.00	\$5,460.00
- Replant Salvaged Trees	19 ea	\$371.25	\$7,053.75
- 24" Box Trees	11 ea	\$200.00	\$2,200.00
- 15 gal. Trees	31 ea	\$100.00	\$3,100.00
- 5 gal. Shrubs	138 ea	\$18.00	\$2,484.00
- 5 gal. Accents	689 ea	\$20.00	\$13,780.00
- 1 gal. Shrubs	690 ea	\$8.00	\$5,520.00
- Hydroseed	7.41 ac	\$2,000.00	\$14,820.00
- Decomposed Granite	35,858 sy	\$3.15	\$112,953.05
- Irrigation	68,897 sf	\$0.35	\$24,113.95
<b>- Landscape Sub-Total</b>			<b>\$257,545.84</b>

**APPENDIX - A**

Subtotal		\$941,422.55
Construction Contingencies	25%	\$235,355.64
<b>Construction Total</b>		<b>\$1,176,778.19</b>
Engineering	10%	\$117,677.82
Construction Administration	6%	\$70,606.69
<b>Subtotal</b>		<b>\$188,284.51</b>
<b>TOTAL</b>		<b>\$1,365,062.70</b>

**NOTES:**

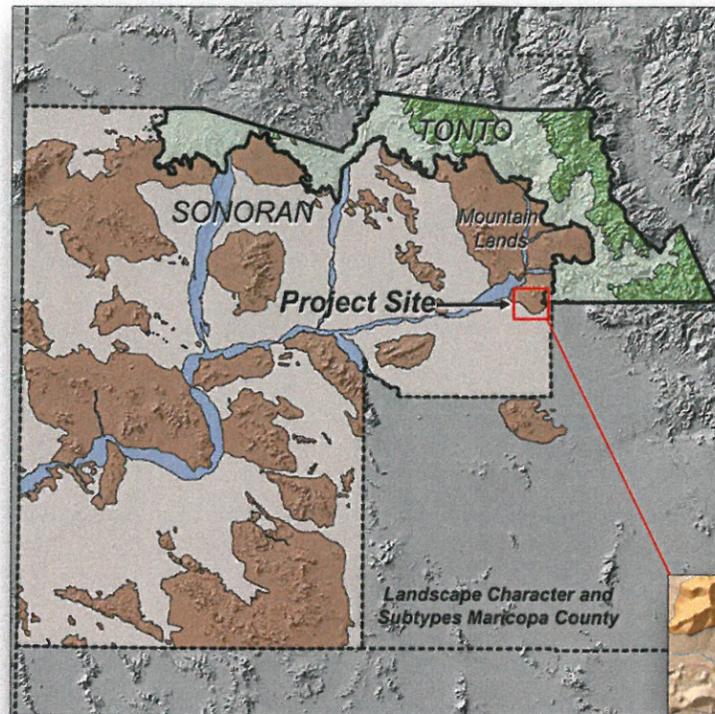
- The estimate is conceptual in nature and is based upon revised concept for Oak Street Basin
  - Estimate does not include costs to purchase land
  - Off-site 84" pipe along Oak Street is not included in this estimate
  - A 360 ft, 60" RCP Out fall pipe along Hawes (south of Oak St) is included
  - Only planted areas are to be irrigated, hydroseeded areas are to rely on natural precipitation.
  - Aesthetic Treatment of Structures = 8% of basin construction costs for earthwork and structures and paving
  - Unit costs for salvage of Saguaros is based on a 35 ft. Saguaro including the length of arms at \$13.00/ft.
  - Unit costs for replanting salvaged Saguaros is based on a 35 ft. Saguaro including the length of arms at \$13.00/ft.
  - Unit costs for salvage of trees is based on the average cost of salvaging 42", 48", 54", and 60" trees
  - Unit costs for replanting salvaged trees is based on the average cost of replanting salvaged 42", 48", 54", and 60" trees
- |  |        |             |              |
|--|--------|-------------|--------------|
| - Total landscape budget (\$40,000 per 1 acre)                                       | 9.4 ac | \$40,000.00 | \$376,000.00 |
| Difference in proposed landscape budget and estimated landscape costs                |        |             | \$118,454.16 |
| Percentage of landscaping relative to removals, earthwork, and structures and paving |        |             | 37.66%       |
- 
- |   |            |            |
|---|------------|------------|
| Estimated area of Disturbance                     | 326,972 sf | 7.51 acres |
| Estimated area to be paved                        | 4,249      | 0.10 acres |
| Estimated area to be hydroseeded                  | 322,723 ac | 7.41 acres |
| Estimated area to be planted and hydroseeded      | 68,897 sf  | 1.58 acres |
| Estimated area to be hydroseeded only (unplanted) | 253,826 sf | 5.83 acres |

## APPENDIX B

### Spook Hill Area Drainage Master Plan Oak Street Basin Design Guidelines

- (1) Perimeter
  - (a) Provide a 30-50 foot landscaped buffer zone around the basin that includes the operation and maintenance (O&M) road.
  - (b) Meander the O&M road to mimic the organic basin configuration.
  - (c) Surface O&M road with native inert material.
  - (d) Supplement the existing vegetation in the buffer zone to increase screening of the basin from Hawes Road and Oak Street as well as from the adjacent residences.
  - (e) Design fencing around basin to blend with surrounding setting in terms of color, material, and form.
- (2) Configuration
  - (a) Create overall basin form that appears more organic and less geometric.
  - (b) Warp and vary side slope ratios from 3:1 to 8:1 and round top of side slopes. Leave natural rock outcrops in basin side slopes.
  - (c) Provide irregular basin bottom slope and large berms/islands or side peninsulas that undulate the floor of the basin and follow the natural topography of the site.
  - (d) Avoid disturbance to saguaros that cannot be transplanted, mature ironwoods (because of slow growth), and to the existing unnamed wash and associated xeroriparian vegetation.
- (3) Vegetation
  - (a) Use plant material from the plant list in the City of Mesa's *Uplands Development Standards* (Ordinance 3693), but select specific species to respond to the context of this basin.
  - (b) Place shrubs, ground covers, rocks, and boulders in an irregular pattern along the sides and top of the basin side slopes.
  - (c) Install temporary irrigation system to establish plant material.
  - (d) Restore density and variety of vegetation to the existing site conditions.
  - (e) Salvage and re-establish indigenous vegetation where possible.
  - (f) Consider views from Hawes Road, Oak Street, and adjacent residences to the basin in the placement of plant material.
  - (g) Salvage surface soil (6-8 inches) from the basin area and replace in the landscaped areas. Maximum stockpile height for surface soil shall be 6 to 8 feet.
- (4) Structural Components
  - (a) Use materials, shapes, and colors that blend in with the surroundings for any side weirs, spillways, dissipaters, and inlets required as determined during final design. Use of boulders native to the vicinity is preferred as a structural component.

**Character Type: Sonoran Desert**  
**Character Subtype: Mountain Lands**



**Mountain Lands: Visual Character**

**Line** – The dominant lines of this subtype include soft, slightly sloping straight lines of the lower portion of the mountains (bajadas) abutting the very angular, jagged, and bold lines associated with the upper slopes and peaks of the mountains. Subordinate lines are those of the foothills that are intermediate between the lower and upper portions of the unit.

**Form** – Essentially, three forms occur in this subtype—slightly sloping plains (bajada), rounded to slightly jagged foothills, and the prominent, rough, and concave form of the mountains.

**Color** – The colors associated with this subtype tend to be subtle grays, blacks, reds, and purples depending on sun position. The vegetation adds a general gray-green to the lower portions of this subtype but is subordinate to the striking bold colors of the exposed rock with desert varnish.

**Texture** – At this scale, the texture is attributed to the variation of form close to the surface of the mountains. These variations cause shadow, which give the mountain lands a general fine to course texture. Towards the upper half of the mountain units where rock outcroppings exist the texture is course. At the lower elevations, the saguaro forests associated with the bajadas result in a fine texture.

**Scale** – The scale of the mountain lands varies, from a few hundred acres to several thousand acres.

**Composition** – The mountains lands are of a feature landscape composing because of their vertical nature and visual presence in the landscape.

**Bajada: Visual Character**

**Form** – Flat predominately fan-shaped rectilinear form.

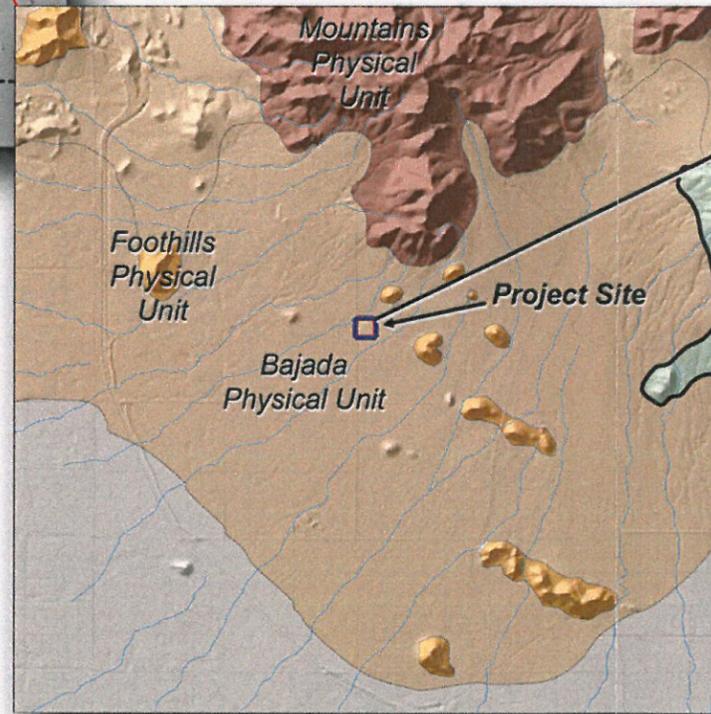
**Line** – Curvilinear line covers the surface of the bajada dominating the horizontal line of the horizon.

**Color** – Grey greens are typical of the bajada and associated with the native desert vegetation. Grays to blacks occur where bare rock exists sometimes with green lichen.

**Texture** – The medium to course texture of this physical unit is caused by the saguaro cactus poking out of the mass of tree and shrubs that typically blanket the land.

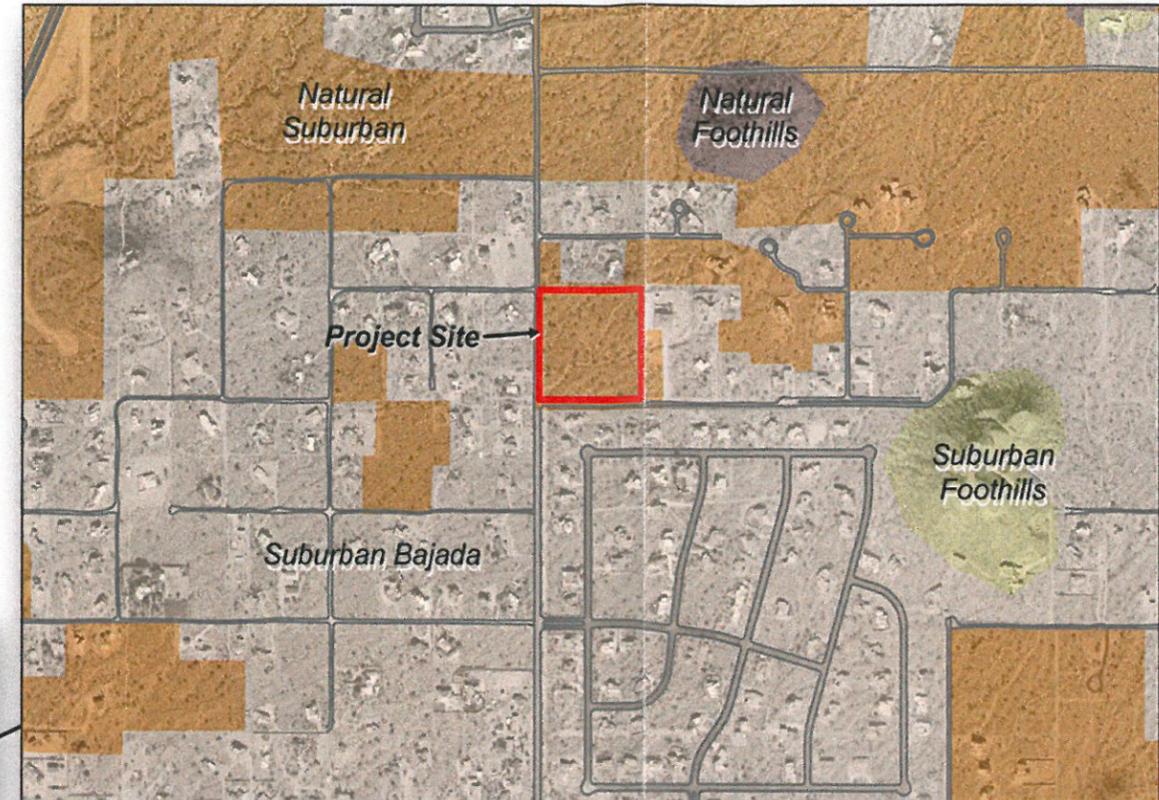
**Scale** – Scale is not articulated in this landscape because the dominant element is vegetation.

**Composition** – The sloping nature of the bajada and associated wide open views are typical of a panoramic landscape.



**Physical Division: Bajada**

**Site Specific Landscape Unit: Natural Bajada**



**Natural Bajada: Landscape Character Description**

The Bajada physical unit occupies approximately 5 percent of Maricopa County. The Bajada is a slightly sloping landform exhibiting a braided network of u-shaped shallow arroyos and shallow drainages. Typically, this physical unit begins at the base of a mountain and extends downward to the valley plains. The soil, composed of primarily detritus (eroded rock, sand, and silt) originating from the mountain slopes and peaks, is extremely fertile and provides excellent drainage. These soil conditions allow Sonoran vegetation to flourish, especially the saguaro, which typically requires excellent drainage for its small root system to function properly. The resulting dense saguaro forests characterize the Sonoran Desert more than any other physical unit.

**Landscape Elements**

**Landform** – Slightly downward sloping landform with surface undulations.

**Vegetation** – Saguaro forests mixed with characteristic dense mixed Sonoran vegetation including palo verde, ocotillo, ironwood, and cactus.

**Water form** – Non-existent except for arroyos that occur within the area and occasionally flow for very short durations because of summertime monsoon storms.

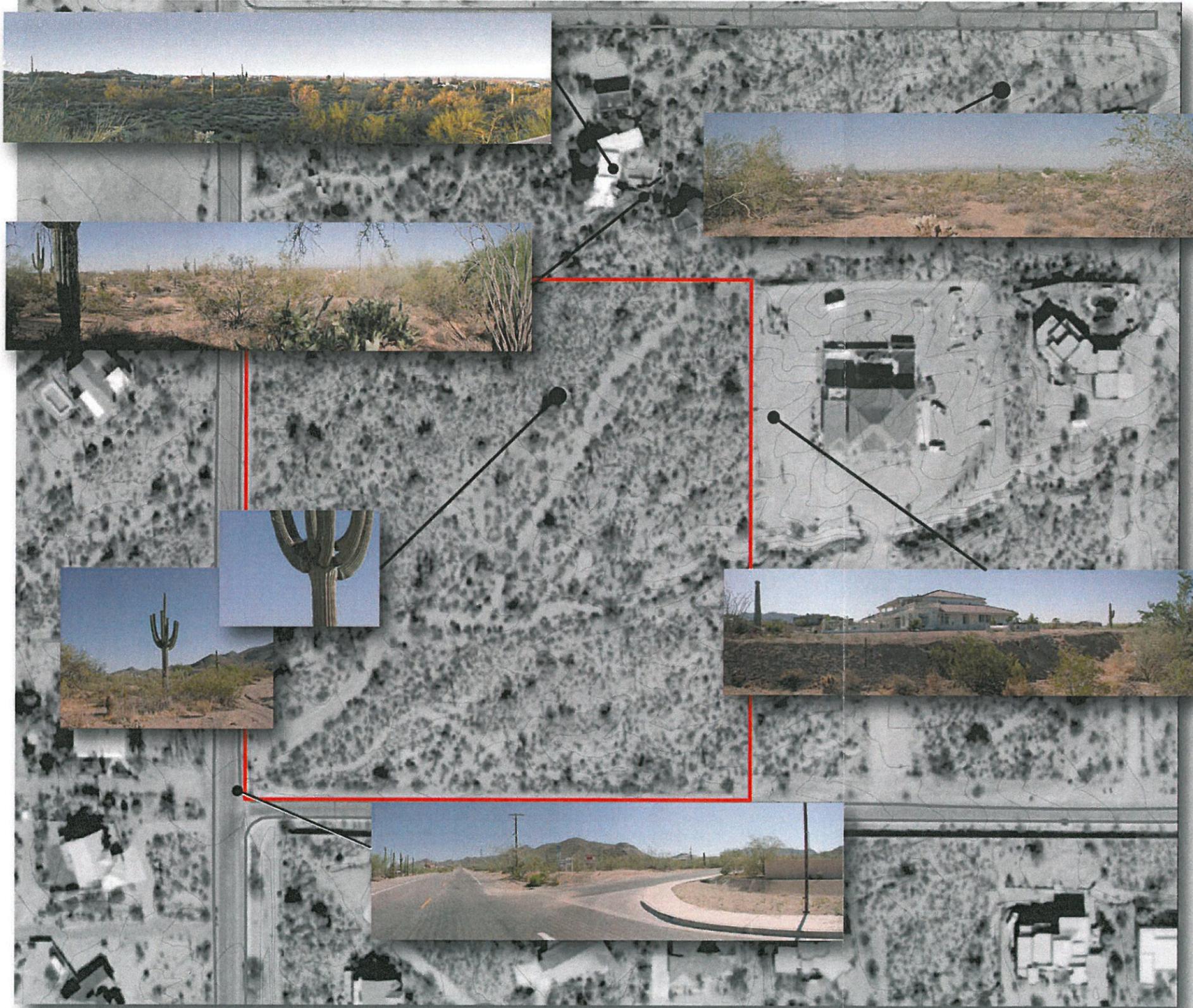
**Rock form** – Occasionally rock cockcrows occur that are void of vegetation.

**Adjacent Landscape Units:**  
**Suburban Bajada**  
**Natural Foothills**  
**Suburban Foothills**

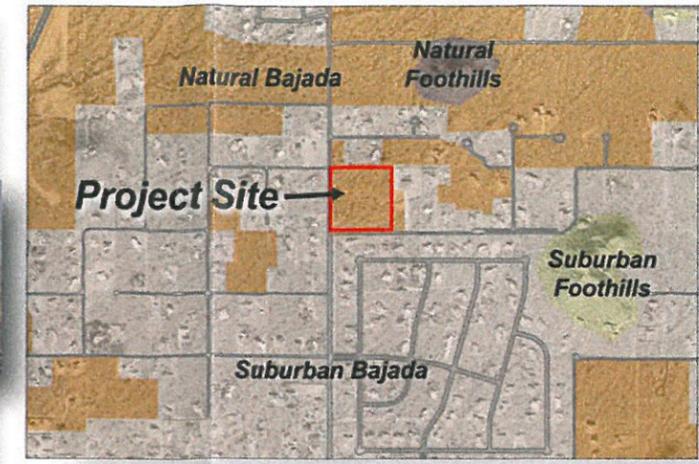
**OAK STREET BASIN**  
**Site Analysis - Landscape Character**



# Site Area



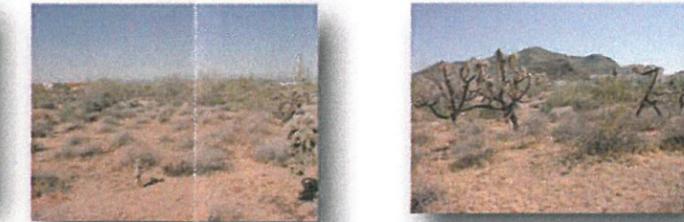
# Local Area



## Vegetation



## Landform



## Rockform



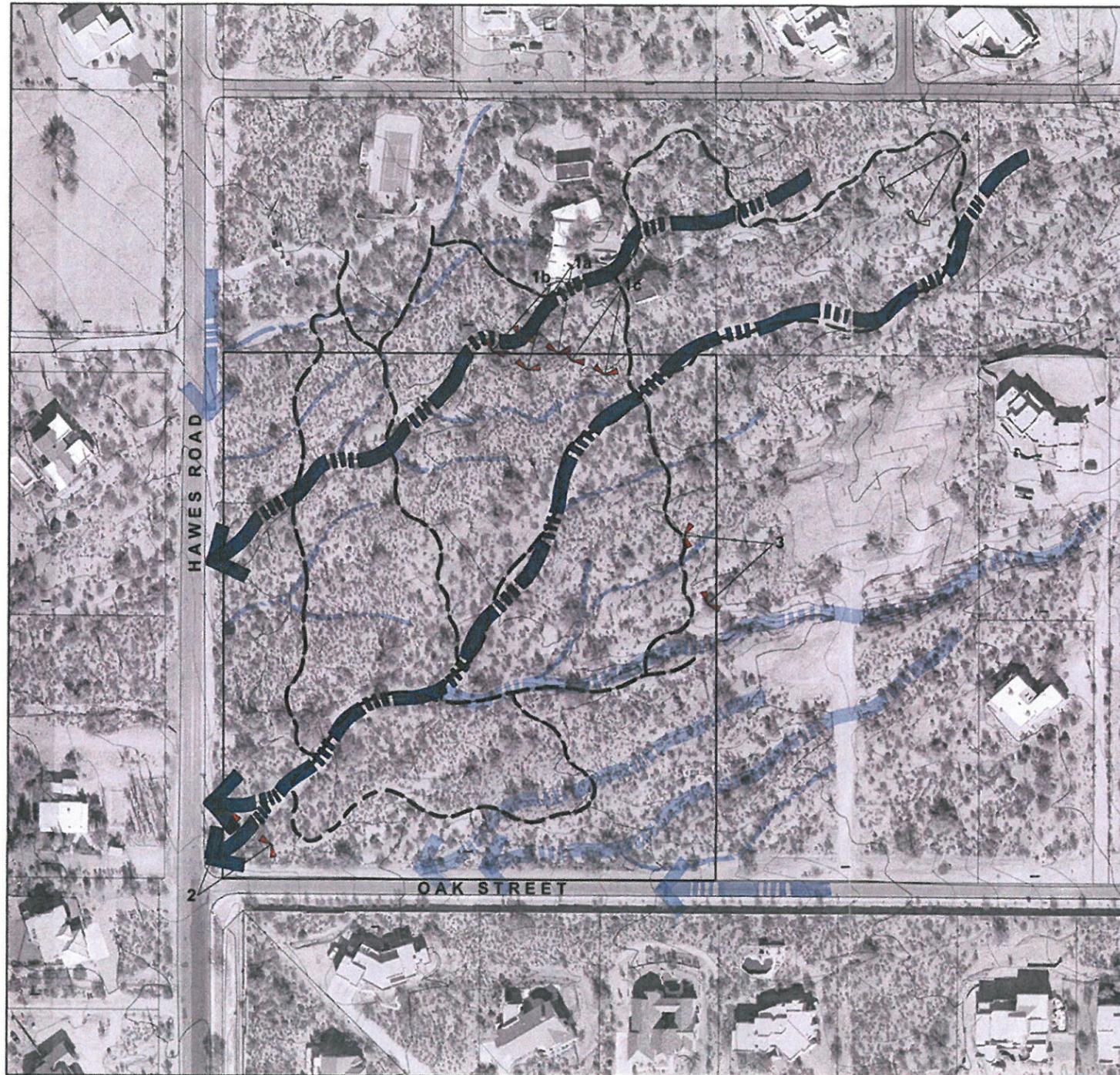
## Waterform



**OAK STREET BASIN**  
Site Analysis - Key Viewpoints and Visual Character



**Site Area** Scale: 1" = 50' - 0"



**OAK STREET BASIN**  
Site Analysis - Site Characterization



**Local Area** Scale: 1" = 600' - 0"



**Legend**

**Jurisdiction**

Site located in Unincorporated Maricopa County  
Parcel size: 9.4 acres

**Ownership**

Private (Henry Douglas)  
To be acquired by FCDMC from Mr. Douglas  
Mr. Douglas purchased the parcel to preserve site as open space and to potentially develop one or two homes on site while preserving natural character  
Adjacent parcels:  
North: owned by Mr. Douglas (dev.)  
Northeast: owned by Mr. Douglas (undeveloped)  
East: private owner (developed)  
South: Thunder Mountain Master planned community (walled off along Oak Street)  
West: large private custom home lots

**Surrounding Land Uses**

Large custom lots on north, east, and west  
Walled-off master planned community to south  
No existing public recreation/trail corridors  
Existing private trail

**Topography**

30' of fall across the site from northeast corner to southwest corner  
Average slope of ±4.0% - 6.0%  
Topography is angular with sharp transitions in form

**Hydrology**

Large wash divides site. Several smaller drainages create detail in the contouring giving diversity to the topography and breaking up the site  
Site primarily drains from northeast to southwest  
Existing wash on north edge flows off-site into natural channel  
Existing wash dividing site flows into existing drainage channel  
Large drainage has exposed sandy bottom  
Some dissection occurring  
Bypass flow is 200cfs  
Peak diversion into the basin in the 100-year, 24-hour event is 823cfs  
Majority of flow enters basin from Oak Street (CFS)

404 Jurisdictional Washes

Secondary Drainages

**Dominant Vegetation**

Saguaros\*  
Palo Verdes  
Ironwood\*  
Creosote  
Bursage  
Cholla cacti  
Ocotillo

**Visual**

Landscape Setting:  
Sonoran Desert Landscape Character Type  
Mountain Lands Subtype  
Natural Bajada Landscape Unit  
Natural Bajada Landscape Subunit

**Prominent Views:**

1. From Douglas residence to site
  - a. Main residence upper deck
  - b. Main residence lower deck
  - c. Guesthouse
2. From corner of Hawes Road and Oak Street
3. From adjacent residences
4. From existing private trail

**Ecology**

Sonoran Desert biome  
Arizona Upland Subdivision  
Sonoran Palo Verde Mixed Cacti - Mixed Shrub Community  
Xeroriparian Desert Habitat

**Suitable Habitat for noted species:**

cactus ferruginous pygmy-owl  
lesser long-nosed bat  
Sonoran desert tortoise  
American peregrine falcon

**Prominent species observed on site:**

Grey Horned Owl (Nest Site)  
Harris Hawk  
Turkey Vulture

**Cultural Resources**

Existing private trail



Date: June 12, 2003

Figure 1.3

**Site Area** Scale: 1" = 50' - 0"



**Local Area** Scale: 1" = 600' - 0"



**Legend**

- 1. Northwest Flats   
(Open flat area on northwest corner of site)
- 2. Northwest Wash   
(Dissected and undulating wash corridor)
- 3. Central Flats   
(Flat gentle sloping open area in the center of the site)
- 4. Eastern Drainages   
(Heavily dissected area with numerous small drainages and exposed rock in the wash bottoms)
- 5. Southwestern Flats   
(Gentle falling grade with rolling topography slightly dissected by small drainages)

**OAK STREET BASIN**  
Site Analysis - Landform



Figure 1.4

**Site Area** Scale: 1" = 50' - 0"



**Local Area** Scale: 1" = 600' - 0"



**Legend**

- |                            |                                 |                                       |                              |
|----------------------------|---------------------------------|---------------------------------------|------------------------------|
| <b>Trees</b>               | <i>Cercodia gigantea</i>        | <b>Groundcover</b>                    | Several varieties of grasses |
| Palo Verde                 | <i>Cercidium floridum</i>       | <b>Map Symbols</b>                    |                              |
| Ironwood                   | <i>Olea tesota</i>              | Trees                                 |                              |
| <b>Shrubs</b>              |                                 | Shrubs                                |                              |
| Creosote                   | <i>Larrea tridentata</i>        | Saguaro                               |                              |
| Bursage                    | <i>Ambrosia deltoidea</i>       | Primary Protection Area               |                              |
| Jojoba                     | <i>Simonsia chinensis</i>       | Secondary Protection Area             |                              |
| <b>Accents</b>             |                                 | Preservation boundary per Mr. Douglas |                              |
| Ocotillo                   | <i>Fouquieria splendens</i>     |                                       |                              |
| Barrell Cactus             | <i>Echinocactus</i>             |                                       |                              |
| Cholla (several varieties) | <i>Opuntia spp.</i>             |                                       |                              |
| Hedgehog Cactus            | <i>Echinocereus engelmannii</i> |                                       |                              |

**Visual Elements**

Trees	Line	Form	Color	Texture	Scale
Saguaro	bold vertical	columnar, linear	light green	directional course	medium
Palo Verde	angular	rounded	lt. blue-green	fine	medium
Ironwood	angular	informal asymmetrical	grayish green	medium	medium
<b>Shrubs</b>					
Creosote	angular	conical from base	deep green	medium	medium
Bursage	angular	rugged, rounded	sage green	medium	small
Jojoba	vertical	dense, rounded	dull gray green	medium	small
<b>Accents</b>					
Ocotillo	vertical	angular from single point	gray, seasonal green	course	medium
Barrel Cactus	vertical	linear	medium green	course	small
Cholla (several varieties)	angular	irregular	medium green	medium	small
Hedgehog Cactus	angular	irregular	brownish green	medium	small
<b>Groundcover</b>					
Several Variety of Grasses	horizontal	low to rounded	golden-green	subtle	small

**OAK STREET BASIN**  
Site Analysis - Vegetation (Draft)



Date: June 12, 2003

Figure 1.5



# OAK STREET BASIN

Alternative 1A

## Summary

Top of Basin	
Elevation:	1810.25
Area:	188,569 sf
Bottom of Basin	
Elevation:	1798.75
Area:	133,089 sf
Average Area:	160,834 sf
Depth:	12.5 ft*
Volume:	2,020,423 cf
Volume:	74,460 cy
* depth includes freeboard	

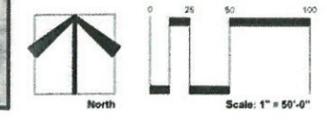
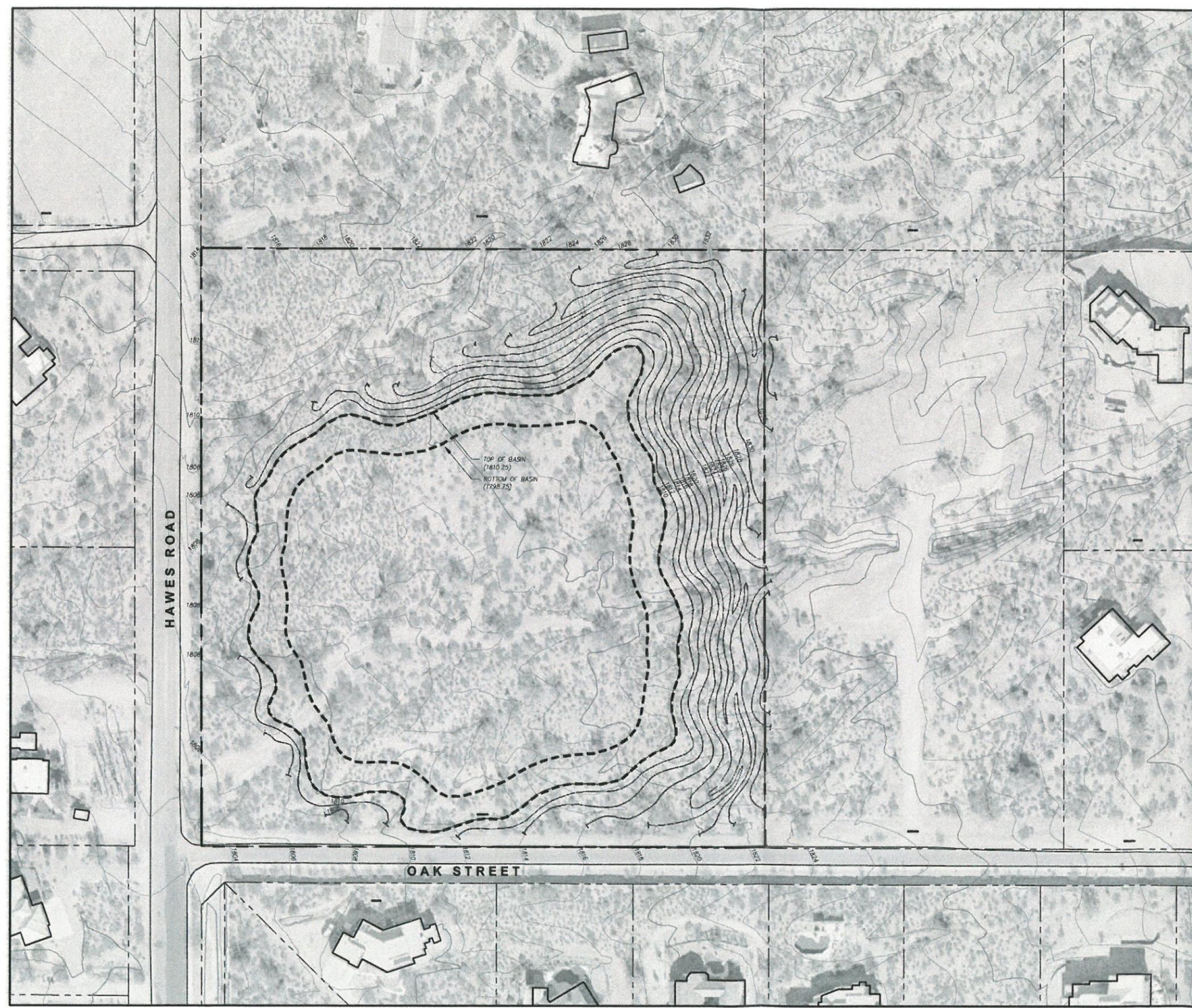


Figure 2.1



# OAK STREET BASIN

## Alternative 1B

### Summary

Top of Basin	
Elevation:	1812.25
Area:	199,373.6 sf
Bottom of Basin	
Elevation:	1798.75
Area:	143,407 sf
Average Area:	171,390 sf
Depth:	14.5 ft*
Volume:	2,142,379 cf
<b>Volume:</b>	<b>92,043 cy</b>
* depth includes freeboard	

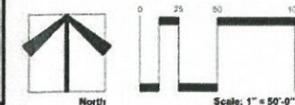
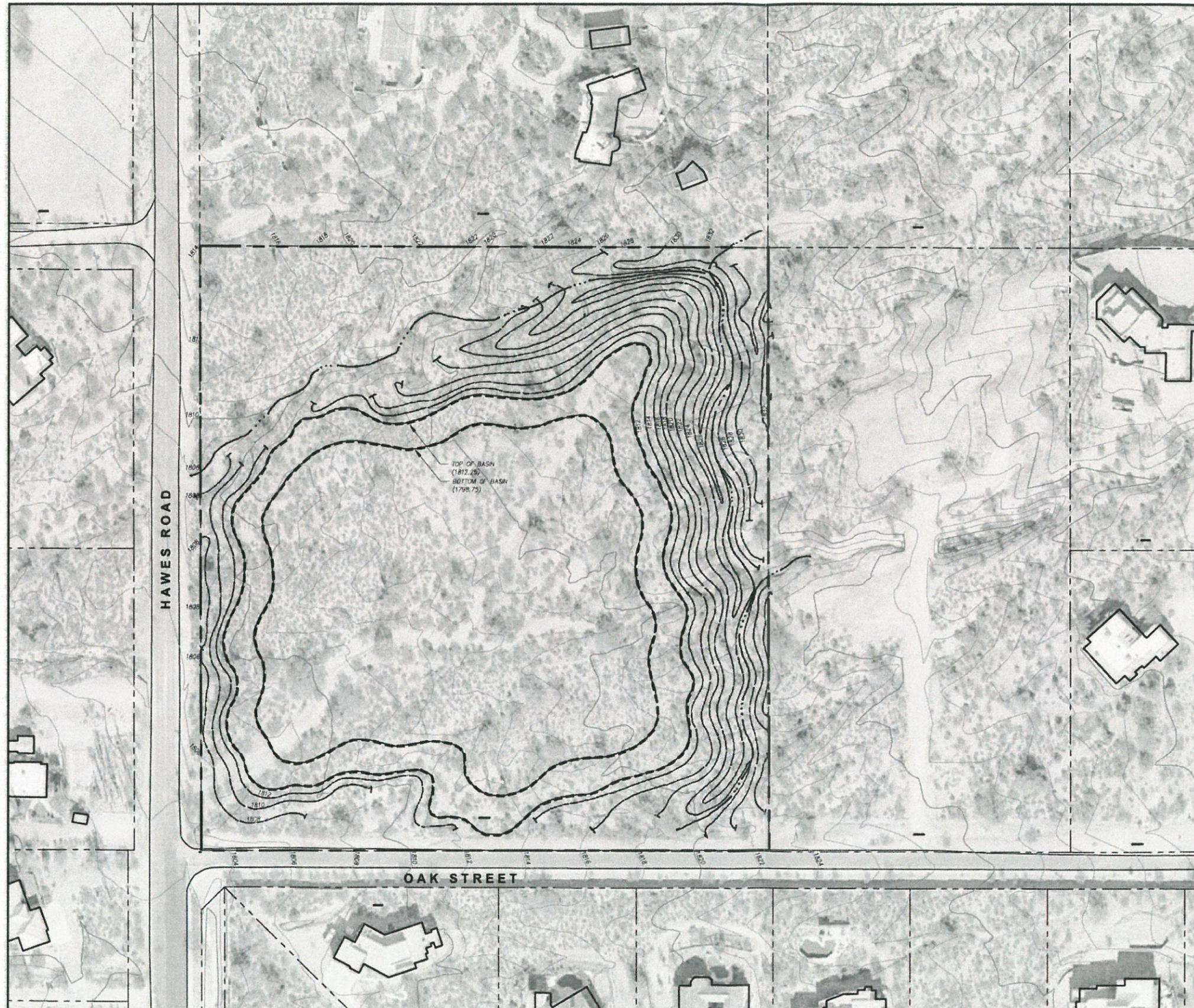


Figure 2.2



# OAK STREET BASIN

## Alternative Two

### Summary

Top of Basin	
Elevation:	1816.25
Area:	177,266 sf
Bottom of Basin	
Elevation:	1798.75
Area:	110,641 sf
Average Area:	143,993 sf
Depth:	17.5 ft*
Volume:	2,518,835 cf
<b>Volume:</b>	<b>93,290 cy</b>
* depth includes freeboard	

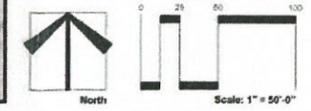


Figure 2.3

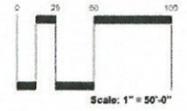


# OAK STREET BASIN

## Alternative Three

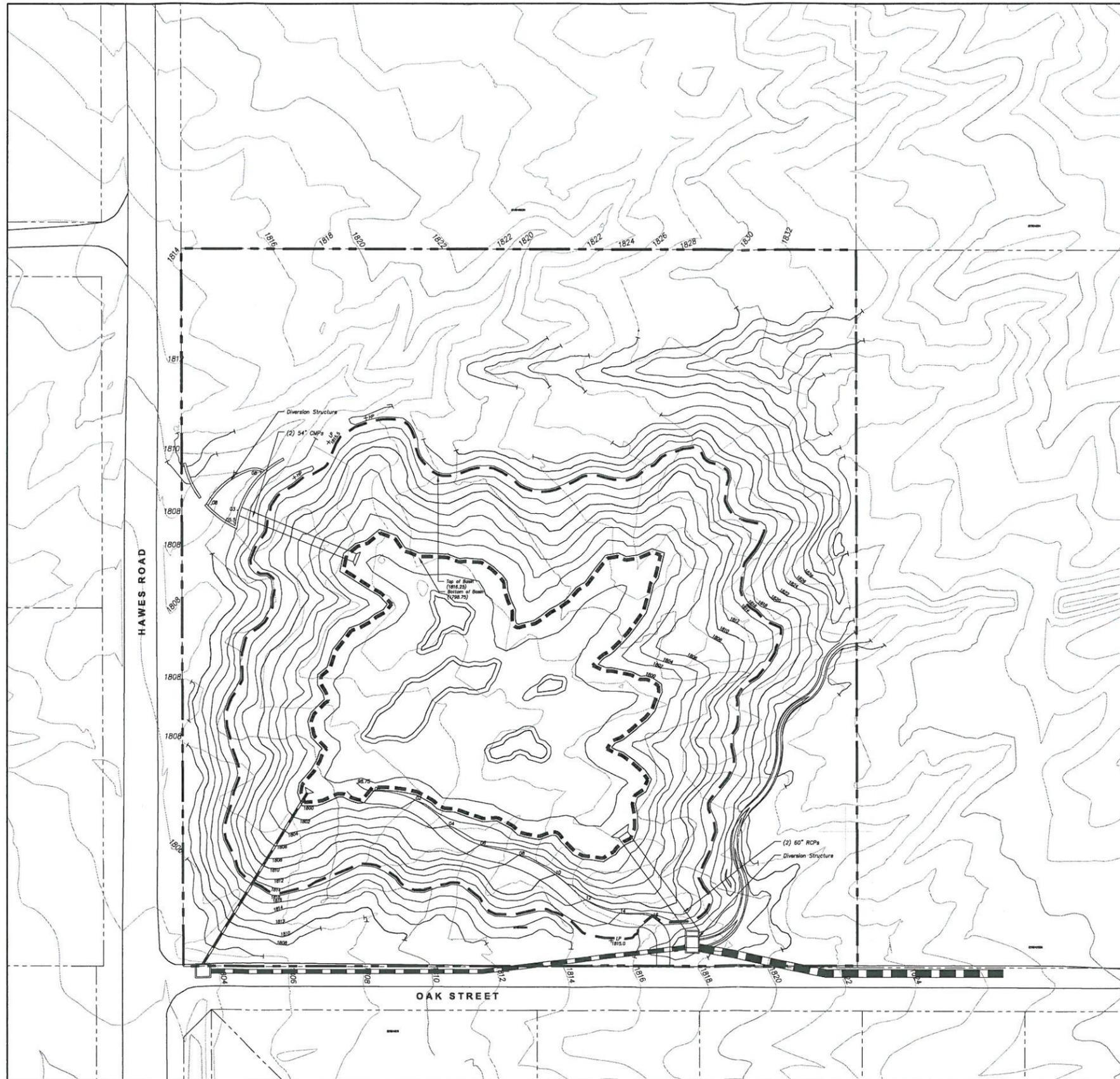
### Summary

Top of Basin	
Elevation:	1816.25
Area:	177,027 sf
Bottom of Basin	
Elevation:	1798.75
Area:	70,190 sf
Average Area:	123,609 sf
Depth:	17.5 ft*
Volume:	2,163,154 cf
<b>Volume:</b>	<b>80,117 cy</b>
* depth includes freeboard	



July 15, 2003

Figure 2.4



# OAK STREET BASIN

## Preferred Alternative Conceptual Grading

### Summary

Top of Basin Elevation: 1816.25

Bottom of Basin Elevation: 1797.75

Depth (including freeboard): 18.5

Volume (not including freeboard):  
64741.58 cy  
40.14 acre-ft.

### Legend

- Property Line
- Channel
- Existing Contour
- Proposed Contour
- Top of Basin
- Bottom of Basin
- █ CMP/RCP

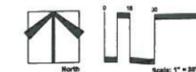


Figure 3.1



**OAK STREET BASIN**

**Preferred Alternative Conceptual Grading**

**Summary**

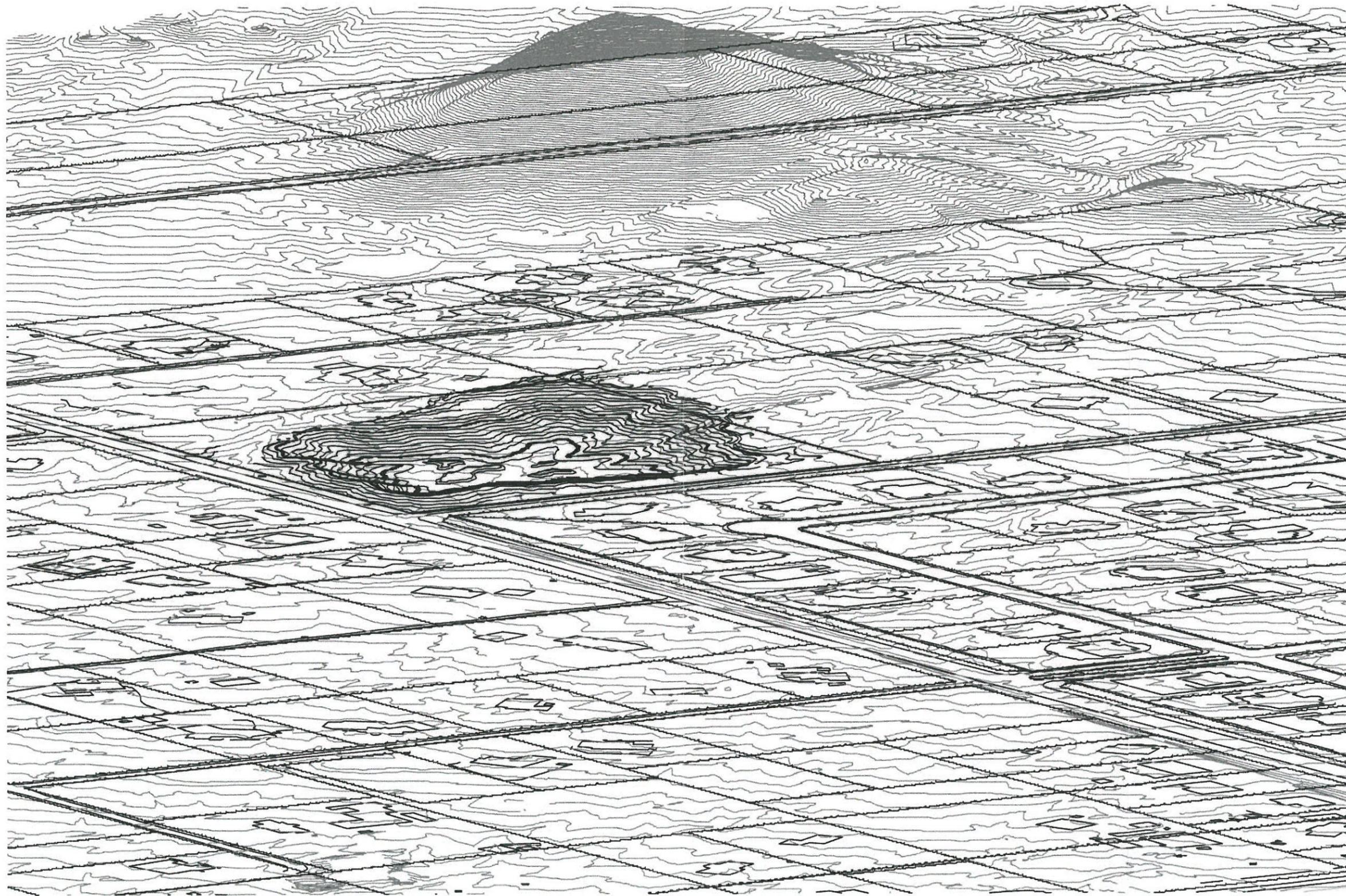
Top of Basin Elevation: 1816.25  
 Bottom of Basin Elevation: 1797.75  
 Depth (including freeboard): 18.5  
 Volume (not including freeboard):  
 64741.58 cy  
 40.14 acre-ft.

**Legend**

- Property Line
- Channel
- Existing Contour
- Proposed Contour
- - - Top of Basin
- · - Bottom of Basin
- █ CMP/RCP



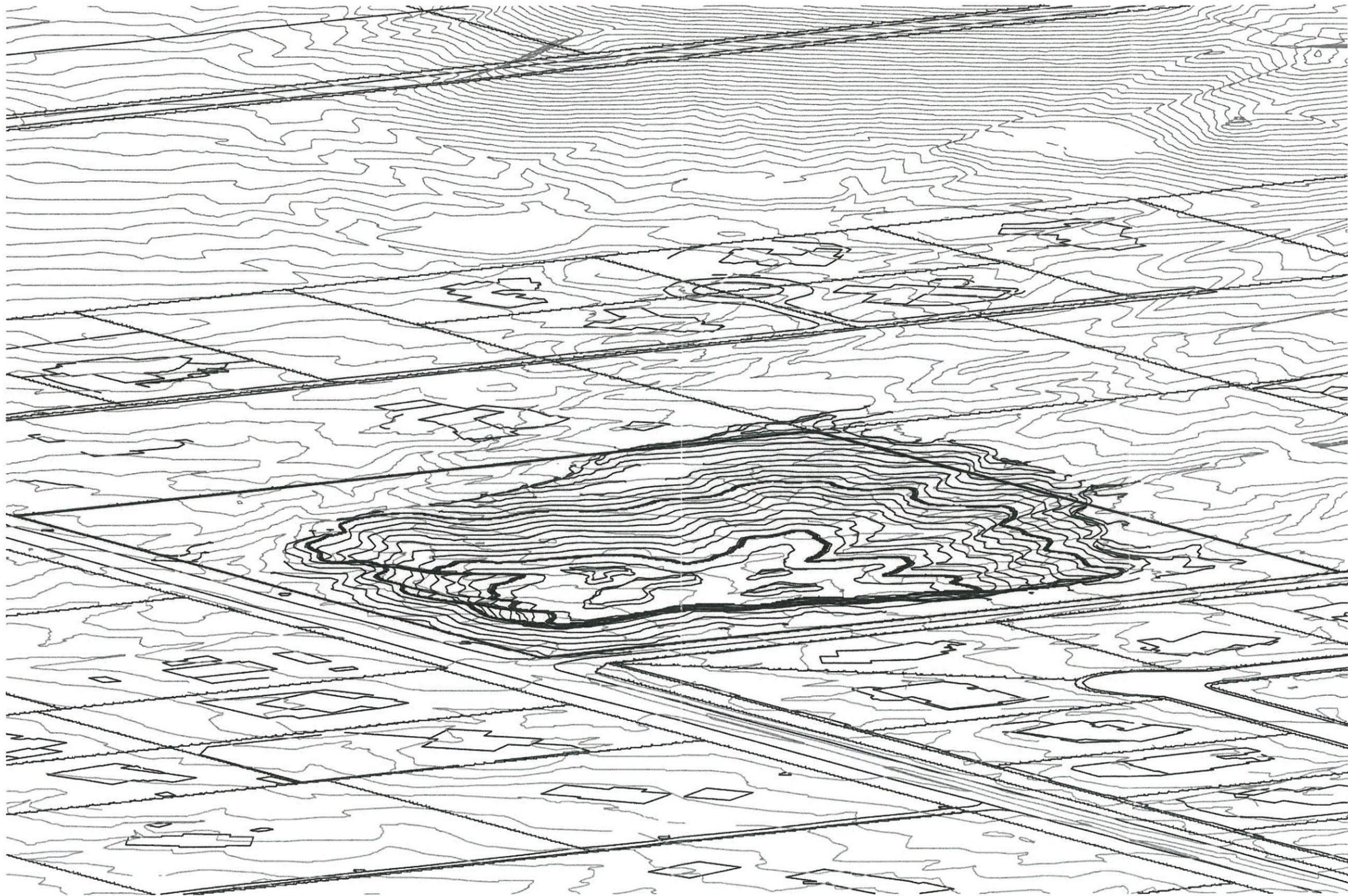
Figure 3.2



**OAK STREET BASIN**  
**Conceptual Grading Plan - Perspective A**



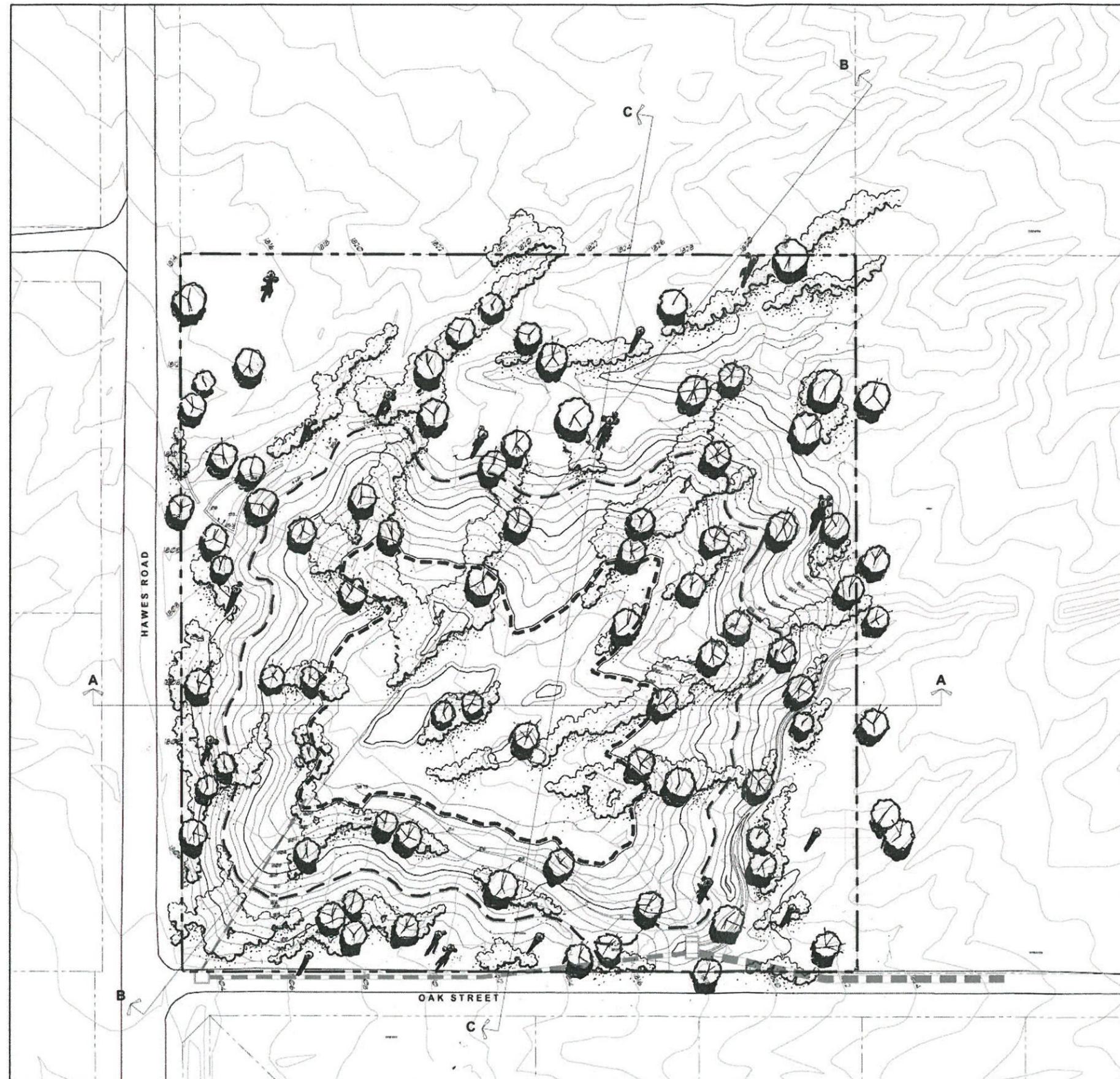
Figure 3.3



**OAK STREET BASIN**  
**Conceptual Grading Plan - Perspective B**



Figure 3.4



# OAK STREET BASIN

## Preferred Alternative Conceptual Planting

### Summary

Top of Basin Elevation: 1816.25  
 Bottom of Basin Elevation: 1797.75  
 Depth (including freeboard): 18.5  
 Volume (not including freeboard):  
 64741.58 cy  
 40.14 acre-ft.

### Legend

- Property Line
- Channel
- - - Existing Contour
- Proposed Contour
- Top of Basin
- Bottom of Basin
-  Tree
-  Saguaro
-  Shrubs



Figure 3.5



# OAK STREET BASIN

## Preferred Alternative Conceptual Planting

### Summary

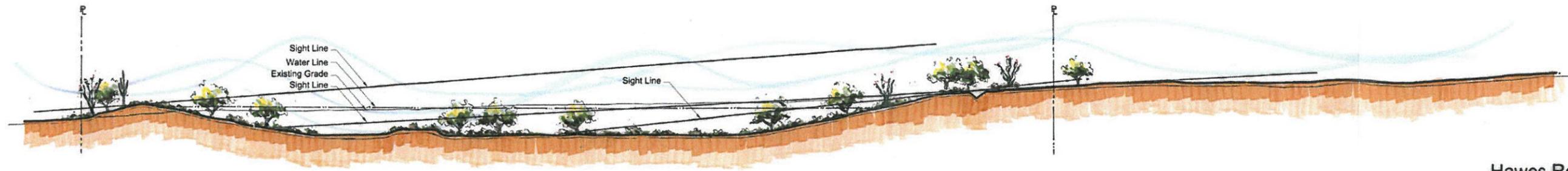
Top of Basin Elevation: 1816.25  
 Bottom of Basin Elevation: 1797.75  
 Depth (including freeboard): 18.5  
 Volume (not including freeboard):  
 64741.58 cy  
 40.14 acre-ft.

### Legend

- Property Line
- Channel
- Existing Contour
- Proposed Contour
- Top of Basin
- Bottom of Basin
-  Tree
-  Saguaro
-  Shrubs



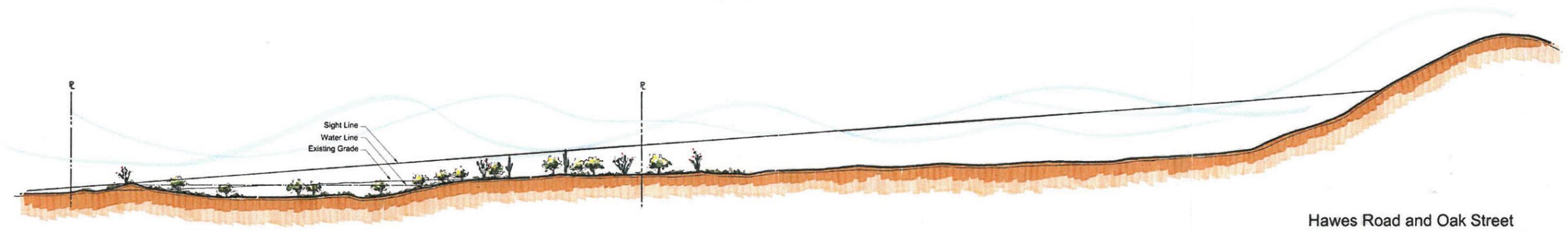
Figure 3.6



Section A

Scale: 1" = 20' - 0"

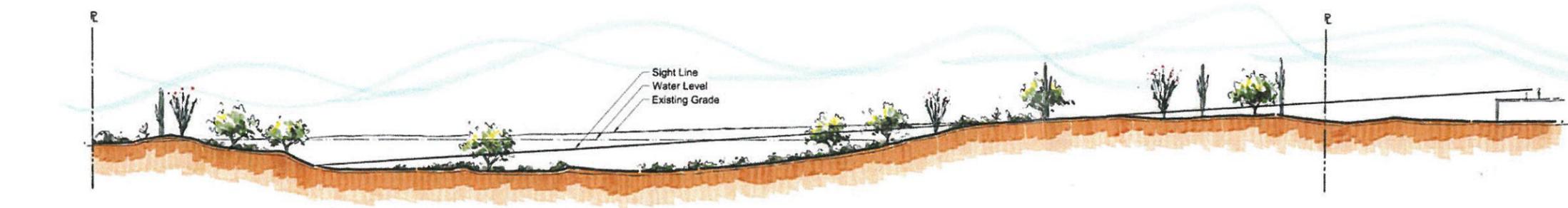
Hawes Road to Adjacent Residence to the East



Section B

Scale: 1" = 40' - 0"

Hawes Road and Oak Street Intersection to Adjacent Foothills



Section C

Scale: 1" = 20' - 0"

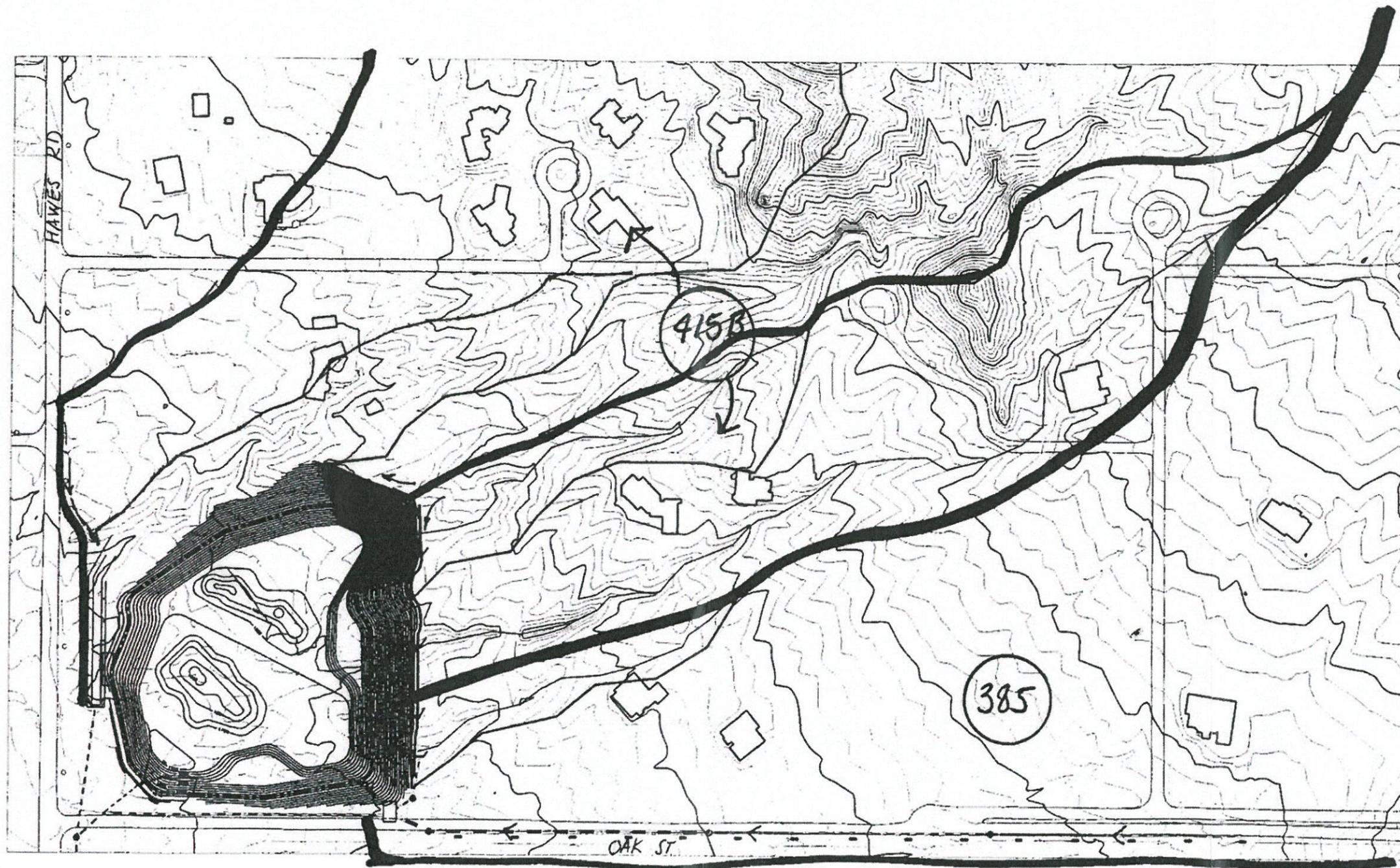
Douglas Residence to Oak Street

**OAK STREET BASIN**  
**Conceptual Basin Design - Sections**



Figure 3.7





**OAK STREET BASIN**  
**Modified Sub-Basin 415B**



Date: February 21, 2004

Figure 3.9