RECOMMENDED PLAN

STP PAPAGO

REGIONAL FLOOD CONTROL PROJECT

WATERSHED STUDY (FCD 95-46)

Prepared for
Flood Control District of Maricopa County

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KVL Consultants, Inc.

Recommended Plan

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STP Papago

Regional Flood Control Project

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Prepared for:

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KVL Consultants, Inc.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
24426
DOUGLAS J.
PLASENCIA
Date Signed 10/10/97
ARIZONA, U.S.A.

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Summary

In September 1995, heavy rainfall caused extensive street drainage problems and led to the flooding of homes in several neighborhoods in southwest Scottsdale. The STP Papago Watershed Study was initiated by the Flood Control District of Maricopa County in response to these problems and in response to a request by the City of Scottsdale to evaluate and resolve drainage issues in the area.

During the project formulation phase, the drainage issues were identified and quantified, producing four key objectives for the project:

- Reduce or eliminate the limits of an existing Zone A floodplain on the west side of the Cross Cut Canal along 66th Street.
- Alleviate higher frequency drainage problems throughout the study area.
- Minimize the size and number of distinct outfall facilities which will discharge to Indian Bend Wash, the Salt River, and the Old Cross Cut Canal.
- Maximize the use of existing conveyance systems including storm drains, canals, drainage easements, and abandoned utility lines.

These key objectives were then used in the alternatives analysis to develop the following recommended plan:

1. Design and construct an Oak Street Outfall for a probable cost of $9.5 million.
   - Coordinate construction in the vicinity of 64th Street with the City of Scottsdale's ongoing roadway design project.
   - Consider the Oak Street retention basins with this outfall.
2. Design and construct an Osborn Road Outfall for a probable cost of $8.2 million.
   - Coordinate construction in the vicinity of 64th Street with the City of Scottsdale's ongoing roadway design project.
   - Consider a revised alignment through the Smitty's parking lot.
   - Consider options to augment the existing storm drain in Osborn Road.

The recommended plan includes this report, supporting calculations under separate cover, and a set of preliminary plans. These should be used as the basis for final design and the preparation of construction documents.

1. Introduction

In September 1995, heavy rainfall caused extensive street drainage problems and led to the flooding of homes in several neighborhoods in southwest Scottsdale. The STP Papago Watershed Study was initiated by the Flood Control District of Maricopa County in response to these problems and in response to a request by the City of Scottsdale to evaluate and resolve drainage issues in the area.

The Kimley-Horn project team was selected to prepare the STP Papago Watershed Study. The following formal milestone reports were prepared as part of the study:

• Hydrology Verification Memorandum	Submitted
• Draft Alternative Plan Formulation	Submitted
• Alternative Plan Formulation	Submitted
• Draft Alternative Analysis	Submitted
• Alternative Analysis	Submitted
• Draft Recommended Plan	Submitted
• Recommended Plan	

This report is the **Recommended Plan**

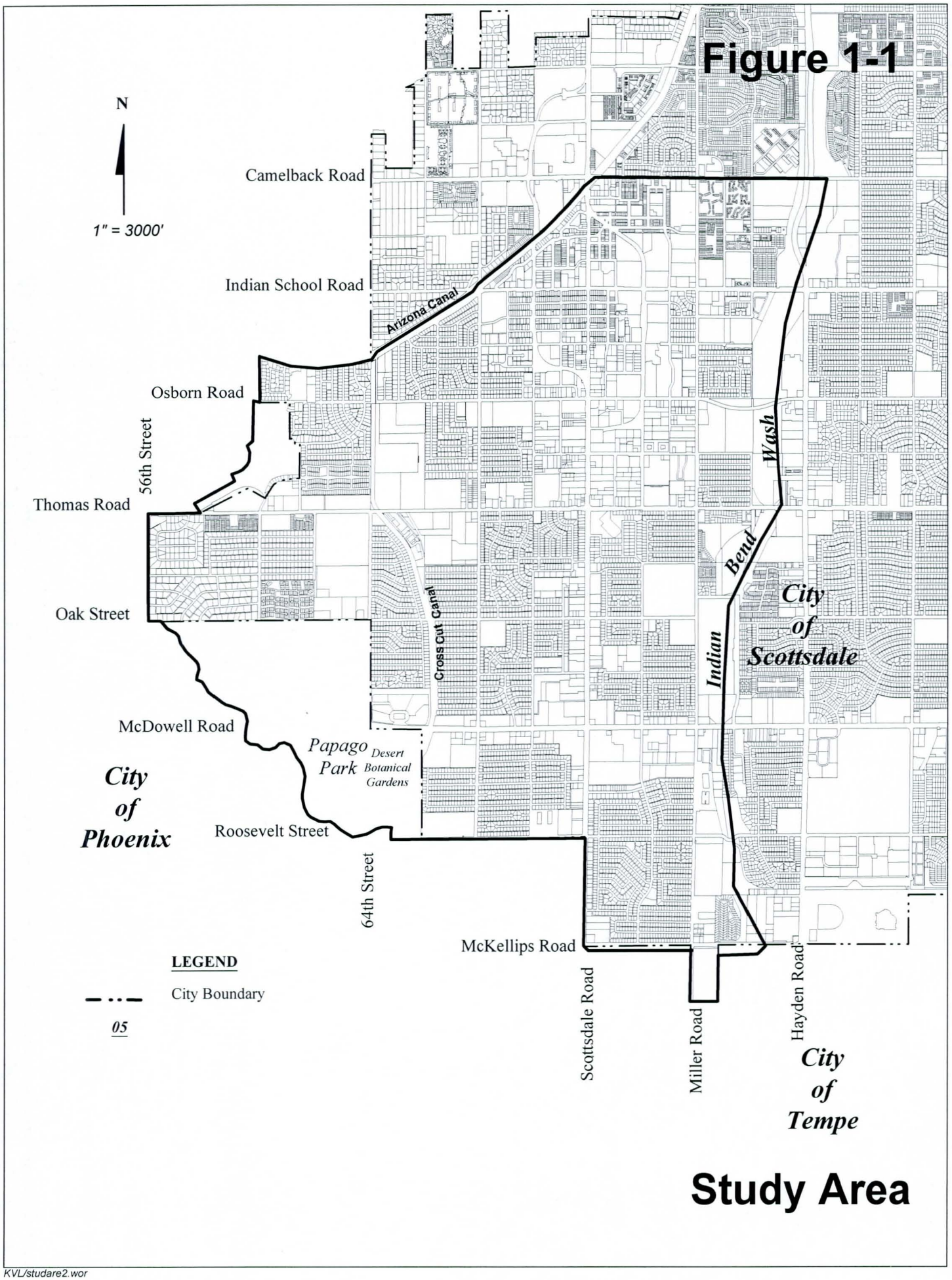
The recommended plan includes this final report, supporting calculations under separate cover, and a set of preliminary plans. This final report includes the following components:

- An introduction and background on the selection of the recommended plan.
- A description of the recommended plan and its performance goals.
- Supporting calculations and results.
- An implementation program.

Study Area

The study area for the STP Papago Watershed Study is bounded by the Arizona Canal and Camelback Road (north), Indian Bend Wash (east), McKellips Road and Roosevelt Street (south), and 56th Street (west), as shown in Figure 1-1. The study area comprises approximately seven square miles and is located primarily in the City of Scottsdale, with a portion of the study area in the Cities of Phoenix and Tempe. Key objectives for the project were developed as a part of the Alternative Plan Formulation and include:

- Reduce or eliminate the limits of an existing Zone A floodplain on the west side of the Cross Cut Canal along 66th Street.
- Alleviate higher frequency drainage problems throughout the study area.
- Minimize the size and number of distinct outfall facilities discharging to Indian Bend Wash, the Salt River, and the Old Cross Cut Canal.
- Maximize the use of existing conveyance systems including storm drains, canals, drainage easements, and abandoned utility lines.



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Acknowledgments

Special thanks to those individuals who helped in the preparation of this report. This includes our sub-consultants, the district representatives, and those who served on the steering committee for the project.

The members of the steering committee were:

Dave Meinhart, City of Scottsdale
Tom Ankeny, City of Tempe
Ray Acuna, City of Phoenix
Tom Sands, Salt River Project
Carolyn O'Malley, Desert Botanical Gardens

The representatives from the Flood Control District of Maricopa County were:

Scott Clement, Project Manager
Raju Shah
Richard Harris
Afshin Ahouraiyan
Marta Dent

Our sub-consultants were:

KVL Consultants, Inc.
Logan, Simpson, and Dye, Inc.
Wood-Patel and Associates, Inc.
Landmark Engineering, Inc.
NEL Laboratories, Inc.

2. Recommended Plan

Background

The recommended plan was developed by identifying drainage issues in the study area, grouping the drainage issues into major areas, and then analyzing the major areas to develop alternatives. The alternatives were then analyzed and compared to determine the recommended plan. The previously submitted Alternative Plan Formulation report and Alternative Analysis report document this process in detail. An overview of the process is provided below for convenience.

Drainage Issues

Sixteen drainage issues were identified in the study area as described in Section 2 of the Alternative Analysis Report.

Alternative Analysis

The drainage issues were grouped into two major areas as described in Section 3 of the Alternative Analysis Report; the **Hy-View Area** and the **Osborn Area**. Possible outfalls were identified and analyzed based on their usefulness in solving the drainage issues and the most feasible alternatives were identified as follows.

Hy-View Area

- Roosevelt Street Outfall to Indian Bend Wash
- City of Tempe Storm Drain to Salt River (with Storage Basins)
- Oak Street Outfall to Indian Bend Wash

Osborn Area

- Osborn Road Outfall to Indian Bend Wash

Comparative Analysis

These four alternatives were then evaluated through a comparative analysis which included consideration of project hydrology, use of existing storm drain, potential for utility conflicts, permit and coordination issues, maintenance of traffic concerns, project viability, and the opinions of probable cost. This analysis is described in Section 4 of the Alternative Analysis Report.

Based on the comparative analysis, public comments, and the consensus of the steering committee, the recommended plan was chosen. It includes the Oak Street Outfall and the Osborn Road Outfall as described herein.

Hy-View Area

Problem Definition

Runoff from Papago Park, the Scottsdale Auto Park, and the Hy-View neighborhood collects in the Scottsdale Auto Park basin at the south end of 66th Street. The basin does not discharge properly causing runoff to pond during a storm event. After the storm event, the standing water must be pumped out of the basin. During a large storm event in September 1995, 14 homes were inundated due to standing water which flooded 66th Street. There are several other minor drainage issues throughout the Hy-View Area.

Oak Street Outfall (Figure 2-1)

The Oak Street Outfall will provide a gravity outfall for the Scottsdale Auto Park basin and eliminate standing water in the Hy-View neighborhood. It is designed to contain the 100 year event in the Scottsdale Auto Mall basin. It is also designed to provide diversions of runoff away from the residential neighborhoods without storm drain systems in place. Finally, it provides an outfall sized to contain the 10 year event for the entire tributary basin. Specific components are as follows:

- Runoff from Papago Park and the Arizona National Guard facility is collected along Oak Street in a 10 year storm drain and diverted east to 64th Street. During a 100 year event, Oak Street will be overtopped and some runoff will flow through the neighborhood north of Oak Street to Thomas Road.
- Runoff from Papago Park and the Armory is collected along 64th Street in a 100 year storm drain and diverted north to Oak Street.
- Runoff from the Hy-View neighborhood is collected along 66th Street in a 10 year storm drain and diverted north to Oak Street, with overflows conveyed south along 66th Street to the Scottsdale Auto Park basin.
- The Scottsdale Auto Park basin outfalls to the storm drain in 66th Street which conveys 100 year basin discharge north to Oak Street.
- Runoff is combined at Oak Street in a 100 year storm drain and is conveyed east under the Cross Cut Canal along Oak Street to Indian Bend Wash.
- The Oak Street Outfall is sized to provide, at a minimum, 10 year protection for the entire tributary basin.
- The drainage system south of McDowell Road will not be modified, except by eliminating the flow currently crossing McDowell Road at the Scottsdale Auto Park. This will be accomplished by installing pipe plugs at both ends of the existing culvert.

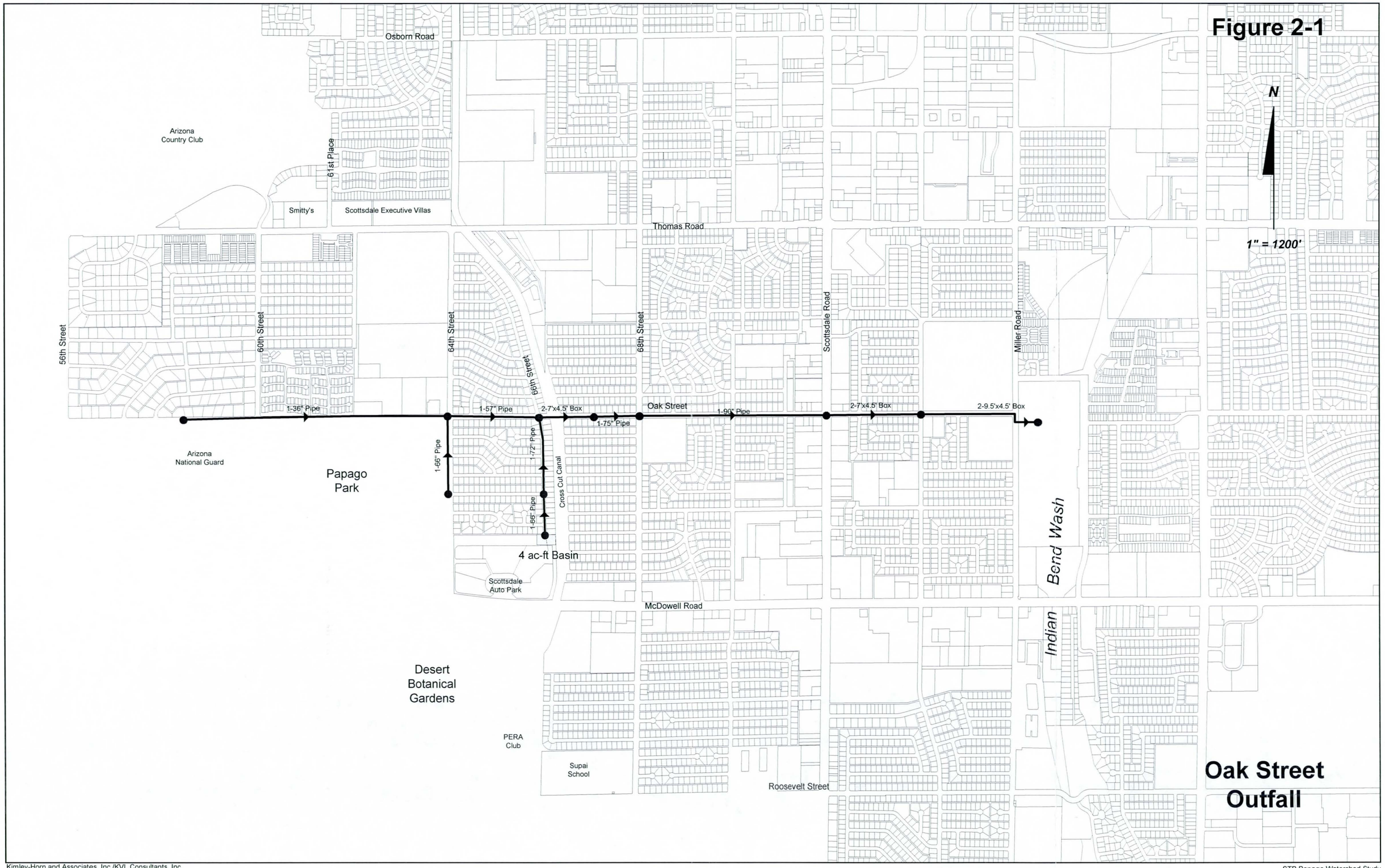
Alternative Variations

During the development of the alternative analysis several variations were considered. The following variations are recommended for continued consideration during the final design of the recommended plan.

Oak Street Retention Basins

Runoff from Papago Park and the Arizona National Guard facility currently flows through the residential neighborhoods to the north. This variation would collect runoff along Oak Street and divert it to two 100 year retention basins. One would be located at 60th Street on the Arizona National Guard facility and the other would be located at the Oak Street entrance to Papago Park. The basins would discharge by a combination of a bleeder pipe along Oak Street and percolation.

Figure 2-1


N
1" = 1200'
Osborn Road
Arizona Country Club
61st Place
Smitty's
Scottsdale Executive Villas
Thomas Road
56th Street
60th Street
64th Street
66th Street
68th Street
Scottsdale Road
Miller Road
1-36" Pipe
1-57" Pipe
2-7'x4.5' Box
Oak Street
1-90" Pipe
2-7'x4.5' Box
2-9.5'x4.5' Box
1-75" Pipe
1-66" Pipe
1-72" Pipe
1-66" Pipe
Cross Cut Canal
Arizona National Guard
Papago Park
4 ac-ft Basin
Scottsdale Auto Park
Bend Wash
McDowell Road
Indian
Desert Botanical Gardens
PERA Club
Supai School
Roosevelt Street
Oak Street Outfall

The basins would provide 100 year protection for Oak Street instead of the 10 year protection provided by the storm drain solution currently in the recommended plan. The basins would also provide a solution which is located at the source of the runoff (in the Papago Buttes). The storm drain variation has a probable cost of about $0.8 million. The basins are expected to require 4 acres for construction and are sized to contain a combined 11 acre-feet of runoff volume, for a probable cost of about $1.2 million.

The value of the anticipated additional cost, public acceptance, and the higher level of protection for this variation are still being considered. The staff of the City of Phoenix parks department and the Papago Park Master Planning Committee of the City of Phoenix Parks Board is supporting further consideration and discussion. The staff of the Arizona National Guard have also agreed to consider this variation further. We recommend further discussions with these stakeholders upon completion of the Papago Park Master Plan.

Hy-View Neighborhood CLOMR

A Conditional Letter of Map Revision (CLOMR) for submittal to FEMA can be prepared which should remove all of the homes in the Hy-View neighborhood from the floodplain upon construction of the Oak Street Outfall. Once construction is completed and reviewed by FEMA, all 160 homes could be removed from the floodplain, for up to an $80,000 annual savings to the residents of the Hy-View neighborhood.

A CLOMR submittal would provide the City of Scottsdale and the District with a review of this recommended plan and comments from FEMA. These comments could then be incorporated into the final design of the Oak Street Outfall. A CLOMR submittal is being prepared as an additional service to this contract.

Osborn Area

Problem Definition

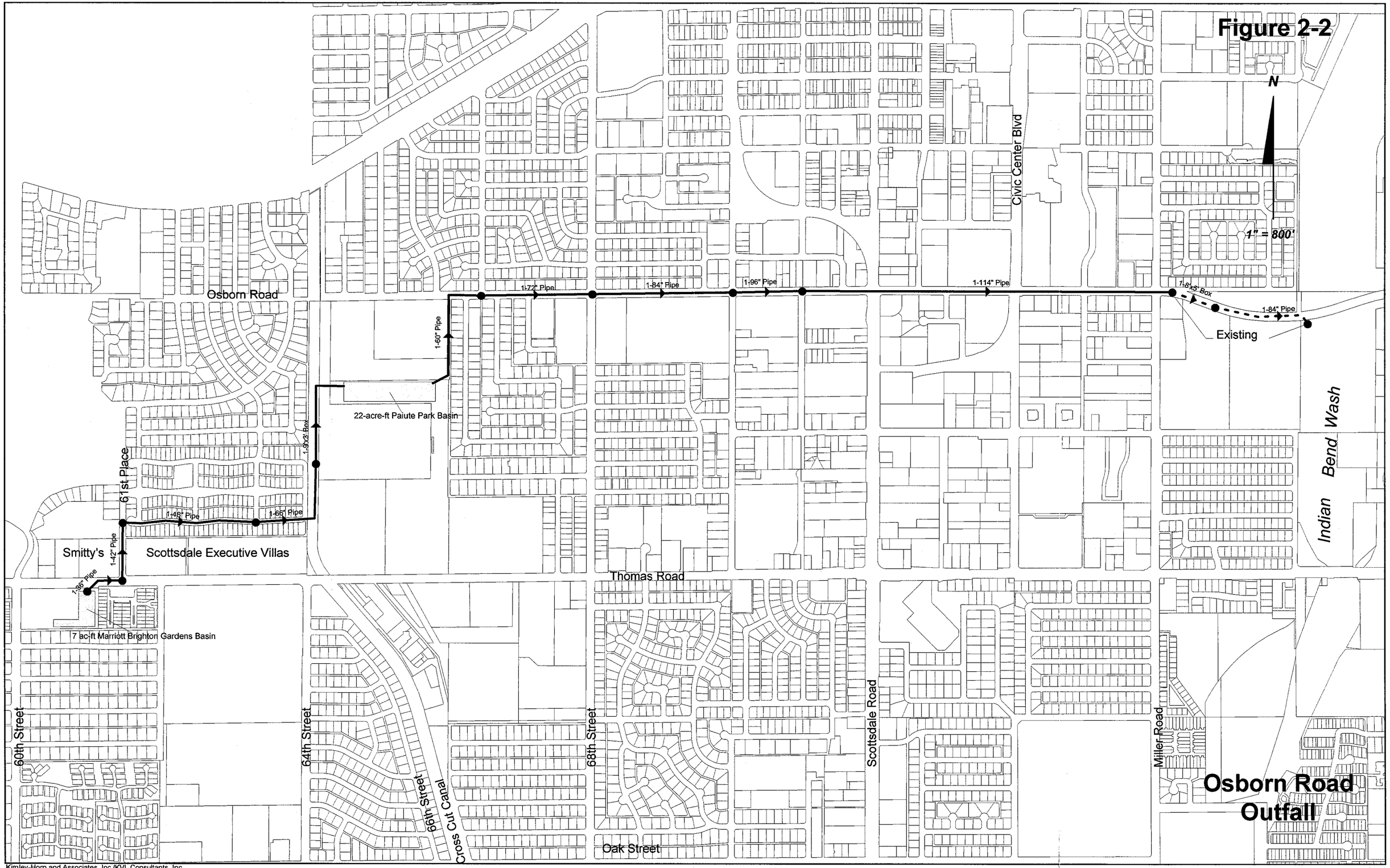
There are two general areas where the identified drainage issues are concentrated.

1. Runoff between Oak Street and the Arizona Country Club in the vicinity of 60th Street creates several local drainage problems since the neighborhoods have an inadequate storm drain system in place.
2. Runoff into Paiute Park has no gravity outfall and is in a topographic low point. The runoff includes a bubble up structure which conveys flows from the west side of the Cross Cut Canal to Paiute Park. When the storage capacity of Paiute Park is exceeded, the runoff will sheet flow through the adjacent neighborhood which has an inadequate storm drain system in place.

Osborn Road Outfall (Figure 2-2)

The Osborn Road Outfall will provide a storm drain with 10 year capacity for both areas with drainage problems. The storm drain will be augmented by basins at Marriott's Brighton Gardens and Paiute Park which reduce the required pipe sizes for the downstream storm drain. The proposed storm drain will tie into an existing storm drain in Osborn Road to reduce project costs. Specific components are as follows:

- Runoff from the residential neighborhood south of Thomas Road is collected in a basin located at Marriott's Brighton Gardens. Marriott's Brighton Gardens basin will be enlarged to detain more runoff, which will reduce the required pipe sizes in the proposed 10 year storm drain downstream. Runoff in excess of the 10 year event will bubble up in the Smitty's parking lot and sheet flow to the Arizona Country Club along existing drainage paths. The basin design may incorporate the staff's plans to construct a courtyard along the east side of the building.



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STP Papago Watershed Study

- Marriott's Brighton Gardens basin will outfall to a 10 year storm drain in Thomas Road. This 10 year storm drain will then divert runoff east along Thomas Road, north along 61st Place, and east along Catalina Drive.
- A stub pipe will be installed at the end of Catalina Drive to allow for future connection of a storm drain. This will provide the City of Scottsdale with the opportunity to divert excess discharge from the abandoned water line in Thomas Road to the Osborn Road Outfall.
- The 10 year storm drain will cross under the Cross Cut Canal at Catalina Drive and collect runoff from 64th Street. The 10 year storm drain will then convey runoff north along 64th Street and outfall at Paiute Park.
- The basin at Paiute Park will detain runoff, which will reduce the required pipe sizes in the proposed 10 year storm drain downstream. Runoff in excess of the 10 year event overtop the basin, allowing runoff to sheet flow east through the adjacent neighborhood. This overtopping will be designed to be less than the existing conditions discharge through the neighborhood. Improvements to park facilities may also be incorporated into the basin design.
- The Paiute Park basin will then discharge to a 10 year storm drain which runs east along Osborn Road and outfalls to an existing storm drain just east of Miller Road.
- The existing storm drain will convey at least a 5 year event to Indian Bend Wash. Excess runoff will bubble up from the storm drain and sheet flow east along Osborn Road to Indian Bend Wash.

Alternative Variations

During the development of the alternative analysis several variations were considered. The following variations are recommended for continued consideration during the final design of the recommended plan.

Smitty's Parking Lot

The storm drain in Thomas Road can be relocated to go through the Smitty's parking lot to reduce the construction in Thomas Road and eliminate construction at the 60th Place intersection. This will lessen the impacts of the project on traffic. This variation may also be coordinated with reducing some internal traffic circulation concerns in the Smitty's parking lot.

Based on City of Scottsdale comments on the Draft submittal and discussion by the Steering Committee for this project, this variation should be incorporated into the final design of the Osborn Road Outfall. This will involve coordination meetings with representatives of Smitty's and changes to the final design.

Use of Existing Storm Drain in Osborn Road

Following the submittal of the Draft Recommended Plan, Kimley-Horn was directed by the Steering Committee to modify the plan by connecting the proposed Osborn Road storm drain to the existing storm drain in the vicinity of Civic Center Boulevard. It was understood that the existing storm drain would not provide a 10 year level of protection. Further analysis revealed that the existing storm drain provides between a 2 year and 5 year level of protection.

At the time of preparation of this report, it was not evident that the District would participate in the implementation of a plan which did not provide a 10 year level of protection. Kimley-Horn was directed to connect a full 10 year storm drain to the existing storm drain as an interim plan. The District will continue to evaluate this situation and determine if another variation should be introduced which will provide for a more effective plan in this area. (The variations we recommend considering, based on our project knowledge are described below):

1. Construct an Osborn Road storm drain with less than a 10 year level of protection.

There is a need to remove some of the existing storm drain to allow connection of the proposed storm drain in the recommended plan presented herein. The remaining existing storm drain will

provide nearly a 5 year level of protection. The existing storm drain being removed would have provided approximately a 2 year level of protection. In either case, a 2 to 5 year level of protection is adequate for street drainage and will reduce or eliminate the most frequent drainage problems in the area. As the City of Scottsdale and the District continue to discuss cost sharing possibilities, this project should be evaluated for a 2 to 5 year solution. This may require some policy modifications by the District, or the programming of the project in the capital projects budget by the City.

Regardless of funding, the Osborn Road Outfall can be reduced in size to provide approximately a 2 year level of protection for all tributary areas. This will allow the use of most of the existing storm drain between Civic Center Boulevard and Miller Road and will reduce the cost for the Osborn Road Outfall.

2. Construct a parallel storm drain to Indian Bend Wash.

The challenge will be to find an alignment for a parallel storm drain which avoids other parallel utilities. One possible alignment might go through the Scottsdale Municipal Stadium parking lot and other adjacent properties since the Osborn Road right of way is crowded. Another possible alignment might go down Earl Road to Indian Bend Wash or another less travelled roadway. The parallel storm drain could then be constructed at deeper depths to drain low flows and could function in conjunction with the existing storm drain to contain the 10 year event.

3. Construct another detention facility for excess runoff.

The most likely location for a third detention facility on the Osborn Road Outfall would be the parking lot and open space in front of the Scottsdale Municipal Stadium along Osborn Road. This is approximately a 2 acre footprint into which stormwater would be diverted for runoff in excess of a 2 year event. This stormwater could then be discharged to the storm drain in Osborn Road and conveyed east to Indian Bend Wash.

Performance Standards and Results

Performance standards for the recommended plan as described above can be summarized as follows.

Table 2-1 Performance Standards

Location	Criteria
Oak St., from 66th St. to IBW	• Design event is 10yr, 6hr • Also, the 100yr, 6hr from the west side of the canal (diverted runoff)
Upper Oak Street Outfall Oak St., from 58th St. to 66th St. 64th St., from Hubbell Rd. to Oak St. 66th St., from Auto Park to Oak St.	• Design event is 100yr, 6hr • Some overtopping will occur along Oak St. and 66th St.
Scottsdale Auto Park Basin	• Peak water surface elevation for 100yr, 6hr will be at least 1 foot below the lowest finished floor elevation along 66th St.
Osborn Road Outfall	• Design event is 10yr, 6hr • Existing Storm Drain has approximately a 5 year capacity east of Miller Road.
Paiute Park Basin	• Peak water surface elevation for 10yr, 6hr event contained in the basin • During larger events, basin will overtop and sheet flow through adjacent neighborhoods. Sheet flow will be less than existing conditions.
Marriott's Brighton Gardens Basin	• Peak water surface elevation for 10yr, 6hr event contained in the basin • During larger events, basin will overtop and discharge to Smitty's parking lot through a bubble up structure. Sheet flow will be less than existing conditions.

This recommended plan meets the project objectives as described in a previous section of this report and provides a solution for most of the drainage issues. Specific results are summarized below.

Table 2-2 Summary of Results

Description of Location	Drainage Issue	Summary of Effects of the Recommended Plan
Hy-View Floodplain (66th Street)	1, 2	The floodplain will be reduced and contained in the Scottsdale Auto Park basin and 66th Street.
Cross Cut Canal at the PERA Club	3	The probability of overtopping of the Cross Cut Canal will be decreased.
Alley at Supai School and 68th St.	4, 5, 6	The volume and peak runoff will be reduced.
Intersection of Thomas Rd. and 64th St.	8, 9	The 64th St. project will drain this area to an abandoned water line in Thomas Rd.
Paiute Park / Neighborhood	10, 16	The volume and peak runoff through the neighborhood will be reduced.
Smitty's on Thomas Rd.	11	The volume and peak runoff through the Smitty's parking lot will be reduced.
Arizona Country Club	12	The volume and peak runoff coming into the Arizona Country Club will be reduced.
Marriott's Brighton Gardens basin	13	The basin will have a gravity outfall to augment the existing bubble up structure.
Neighborhood South of Thomas Rd.	14,15	The volume and peak runoff will be reduced.
Use of existing conveyance systems.	n/a	• Existing Osborn Road storm drain, from Miller Road to IBW will be used. • Part of the 64th Street roadway project will discharge to an abandoned water line in Thomas Road.
Indian Bend Wash (IBW)	n/a	There will be no significant difference in peak discharge to IBW.
The Study Area	n/a	There will be no significant difference in peak discharge from the study area.
Number of Outfall Facilities	n/a	No additional outfall facilities will be installed. Only the Oak Street Outfall will be increased in size.

3. Supporting Calculations

Introduction

This section provides a description of the preliminary plans and the methodology for the supporting calculations in the recommended plan. The methodology includes: preparation of preliminary plans, hydrology, hydraulics, property ownership, utilities, use of existing storm drain, permit and coordination issues, water quality, erosion and sediment control, maintenance of traffic, project viability, special design considerations, and opinions of probable cost.

Preparation of Preliminary Plans

Preliminary plans were prepared to demonstrate the hydraulic performance of the system, to identify the potential for significant utility conflicts, and to support the refinement of the opinion of probable cost. These design plans are preliminary and, as such, will not contain the details associated with a set of construction documents. Final design and construction documents should be prepared under separate contract.

The preliminary plans include a cover sheet, index of sheets, and plan and profile sheets. These will be delivered in an AutoCAD, Version 12 format and are further described below.

Cover Sheet

The District's standard cover sheet was used.

Index of Sheets

A sheet index for the Oak Street Outfall and a sheet index for the Osborn Road Outfall is included.

Plan and Profile Sheets

Prepared based on the following guidelines.

Property and Right of Way Lines - Based on City of Scottsdale (COS) GIS system, TRW data, available as-builts, and project coordination meetings. See the Property Ownership section of this report for more detail.

Proposed Easements/ Right of Way - Proposed easements will be shown and labeled with approximate dimensions.

Edge of Pavement - Based on COS GIS system.

Topography - 1 Foot Contour intervals in COS are based on COS GIS system. 2 Foot Contour intervals in City of Phoenix (COP) are based on the aerial mapping prepared for this project. Since the Oak Street Outfall includes both sets of topography, a 2 Foot Contour interval was used on the preliminary plans. A 1 Foot Contour interval was used on the preliminary plans for the Osborn Road Outfall.

Proposed Storm Drain - Presented in plan and profile view in sufficient detail to support the hydraulic modeling of the regional system. Construction baseline, proposed pipe, and proposed manholes and junction boxes for access are shown.

Existing Utilities - Shown as described in the Utilities Section of this report.

Utility Conflicts - Shown as described in the Potential for Utility Conflicts Section of this report.

Match Lines - Shown with Sheet References.

Proposed Contours - Proposed Contours were designed to tie into the existing contours for the basins only, since no changes to the existing topography were made outside of the basins.

Outfall Structure - The approximate location and type of outfall structures was shown. No construction details were provided.

Basin Data - The approximate peak stage, peak discharge, and peak storage volume (for the design event) of each basin is shown on the plans to demonstrate performance.

Profile of Existing Grade - Shown based on topography and the construction baseline information described above.

Profile of Storm Drain - Shown including a description of length, inverts, slope, size, and material type.

Hydraulic Grade Line - Shown for the design event only.

Utility Crossings - Utilities crossed by the proposed storm drain are shown on the profile and labeled based on an assumed depth. See the Potential for Utility Conflicts section for more detail.

Other Plan Sheets - No plans were developed for maintenance of traffic, junction structures, utility adjustments, trench details, cross sections, or any other details. These are anticipated to be incorporated into the final design and construction documents to be prepared under separate contract.

Hydrology

Hydrologic modeling of the study area was performed using the U.S. Army Corps of Engineers Flood Hydrograph Package (HEC-1). The modeling was based on the HEC-1 files developed as part of the City of Scottsdale Stormwater Master Plan and Management Program. The results were reviewed and modified as needed for this project. In performing these revisions, care was taken to use the same methodology and sources as were used in the original HEC-1 files.

The City of Scottsdale Stormwater Master Plan and Management Program is based on the City of Scottsdale's Facility Management System. The facility management system is a computerized database which uses spatial analysis techniques and computer programming to link the data and automate some of the hydrologic modeling.

The details of the hydrologic methodology and results are provided in Appendix D to this report. The HEC-1 output for a 10 year, 6 hour event is provided in the supporting calculations for this report.

Hydraulics

A complete hydraulic design of the recommended plan was conducted for this project. The design standards were based on discussions with District staff and generally follow the procedures outlined in the "Drainage Design Manual for Maricopa County, Volume II, Hydraulics". Performance standards are based on discussions with the steering committee and District staff.

The details of the design and performance standards are provided in Appendix E to this report, along with hydraulic results. The HGL for the design event and the maximum water surface elevations in the basins are shown on the preliminary plans to demonstrate performance.

Property Ownership

Methodology

Rights of way and parcels adjacent to the recommended plan were examined in order to determine the property ownership. This was accomplished through the use of the TRW-REDI Map Book for Maricopa County, Arizona (1996-97 edition). Property ownership was also discussed with affected property owners and was verified by reviewing available site plans and as-builts. Property lines were shown on the plans based on this research and the parcel mapping obtained from the City of Scottsdale GIS system. Deed research and right of way designation was not conducted as part of this study.

Proposed easements required for the recommended plan are shown on the preliminary plan drawings. Estimated costs to purchase the rights of way and easements are based on the Easement Cost Analysis prepared by Al Dickie of the District's Land Management Division on June 18, 1997 (Appendix G). The costs are included as a line item in the opinion of probable cost.

Results

A summary of the results of the property ownership research is shown in Table 3-1.

Table 3-1 Property Ownership Summary

Property	Owner	APN
Oak Street Outfall		
Papago Park	City of Phoenix	129-38-001A
South ½ of Oak St., between 56th St. & 60th St.	Bureau of Land Management (AZ National Guard facility)	not researched
South ½ of Oak St., between 60th St. & 64th St.	City of Phoenix	129-38-001A
Oak St., between 64th St. & IBW	City of Scottsdale	not researched
Cross Cut Canal at Oak St.	Salt River Project	not researched
64th St., between McDowell Rd. & Oak St.	City of Scottsdale	not researched
Scottsdale Auto Park	Hubert G. & Dorothy G. Pitre	129-09-003M
66th St., between Scottsdale Auto Park & Oak St.	City of Scottsdale	not researched
IBW at Oak St.	City of Scottsdale	131-22-007A
Osborn Road Outfall		
Marriott's Brighton Gardens of Scottsdale	Health & Rehabilitation Properties	129-26-001F
Thomas Rd., between 60th St. & 61st Pl.	City of Scottsdale	not researched
Catalina Drive, Cul-De-Sac at West End	Ronald and Shirley Baer	128-49-061
61st Place, between Thomas Rd. & Catalina Dr.	City of Scottsdale	not researched
Catalina Dr., between 61st Place & Cross Cut Canal	City of Scottsdale	not researched
Cross Cut Canal at Catalina Dr.	Salt River Project	not researched
64th St., between Catalina Dr. & Paiute Park	City of Scottsdale	not researched
Paiute Park	Salt River Project	130-50-001F
Osborn Rd., between Paiute Park & Civic Center Blvd.	City of Scottsdale	not researched

The table shows that there are seven property owners directly affected by the recommended plan:

1. City of Phoenix
2. Bureau of Land Management (AZ National Guard facility)
3. City of Scottsdale
4. Salt River Project
5. Hubert G. & Dorothy G. Pitre (Scottsdale Auto Park)
6. Health & Rehabilitation Properties (Marriott's Brighton Gardens)
7. Ronald and Shirley Baer (West End of Catalina Drive)

Utilities

Methodology

All utility owners within the study area were identified through an inquiry with Blue Stake. Utility owners were then contacted and asked to provide copies of all applicable facility maps and as-builts in the study area.

These maps were used to develop plans showing the horizontal location of existing utilities which may impact the recommended plan. These plans were used to field verify the approximate locations of above ground appurtenances such as manholes, end walls, storm drain inlets, grate inlets, valves boxes and fire hydrants. The mark-ups developed in the field were then incorporated into the preliminary plans. They were then sent to the utility owners for comments regarding their facilities as shown on the plans. The comments from the utility owners were then incorporated into the final recommended plan. See Appendix G for copies of the response letters from the utility companies.

All utilities were shown in an approximate vertical location based on conversations with the utility owners and assumed depths. Vertical locations of storm drains, sanitary sewers, and SRP irrigation structures were determined by field survey where the structures were accessible and impacted the recommended plan. No pothole information will be obtained as part of this project, although it is recommended for final design.

Determination of Utility Owners

The following utility owners were identified by Blue Stake as having facilities within the study area.

Table 3-2 Utility Ownership Summary

Owner Name	In Study Area	In Recommended Plan Area
City of Scottsdale	X	X
City of Tempe	X	
City of Phoenix	X	X
Arizona Department of Transportation	X	
Arizona Public Service	X	X
Cox Communications	X	X
TCI Cable	X	X
Salt River Project	X	X
US West	X	X
Southwest Gas Corporation	X	X
Circle-K	X	
Mobile Oil Company	X	
Texaco Corporation	X	
Octopus Car Wash	X	
Outdoor Systems	X	

Of the eight utility owners affected by the recommended plan, only Cox Communications and TCI Cable were determined to have negligible impact on the recommended plan and were not contacted for this study.

Potential for Utility Conflicts

The potential conflicts with existing utilities were quantified as part of this recommended plan. Available record drawings, facility maps, and some survey data were collected and reviewed to provide an idea of the types of utility conflicts to be expected. Based on the available data and conversations with the utility owners, the potential utility conflicts were identified. Estimated costs for utility conflicts were then determined based on conversations with the utility owners, District Bid Tabulations on recent projects, and the 10th Annual Edition of the Means Heavy Construction Cost

Data. The detailed costs are described in Appendix C of this report and are summarized as a line item in the opinion of probable cost.

Use of Existing Storm Drain

Tables showing existing storm drain capacities were obtained from the City of Scottsdale Stormwater Master Plan and Management Program and provided as an appendix in the Alternative Plan Formulation Report previously submitted. Based on these tables and the preliminary plans, the opportunities for the use of existing storm drains were evaluated.

Oak Street Outfall

There is an existing 36" to dual 48" diameter storm drain in Oak Street from 70th Street to IBW (about 4,500 feet). Due to the amount of parallel utilities, however, this existing storm drain will be removed and replaced with a larger storm drain for the recommended plan. The larger storm drain will follow the alignment of the existing storm drain to try to avoid utility conflicts.

Osborn Road Outfall

There is an existing storm drain in Osborn Road that runs west from Brown Avenue to the Scottsdale Road storm drain. The Osborn Road storm drain would require redirecting the flow east towards Indian Bend Wash which precludes the use of this existing storm drain.

There is an existing 72" to 84" diameter storm drain in Osborn Road that runs from approximately Civic Center Boulevard east to IBW. The storm drain has approximately a 2 year capacity for the entire tributary basin. Based on conversations with the District, the City of Scottsdale, and the steering committee, it's use has been incorporated into the recommended plan and variations to augment it's performance have been added to this report.

Permit and Coordination Issues

A preliminary investigation was conducted to determine the types of permit and coordination issues which are anticipated for final design. The results reveal no major obstacles.

- For construction in the City of Phoenix, plan reviews will be required by the Project Engineering Department and the Streets and Transportation Department.
- For construction in the City of Scottsdale, plan reviews will be coordinated through the Development Services Department.
- For outlet works in IBW, compliance with Section 404 of the Clean Water Act through the US Army Corps of Engineers regulatory program is required.
- For reduction or elimination of the Hy-View floodplain, a CLOMR submittal to FEMA is required. A preliminary submittal will be prepared as additional services for this study.
- For hydrologic and hydraulic impacts on IBW, coordination with the US Army Corps of Engineers engineering staff is required.
- For outlet works in IBW, compliance with Sections 401 and 402 of the Clean Water Act through the Arizona Department of Environmental Quality regulatory program is required.
- Easements or land acquisition will be required for at least 3 private property owners.
- At least six private utility owners share use of the rights of way in the recommended plan and should be contacted to determine prior rights during final design.

Water Quality

Water quality was considered an important consideration in developing the recommended plan. It was assessed with a multiple approach. Limited field sampling was conducted at up to six (6) sites in the study area. Precipitation events were sampled twice; once during the first flush and once at a later point in the runoff event (With the exception of Sites 7 and 8.) The analysis regime for this sampling was determined based on existing land uses in the basin and existing or anticipated land use in the receiving area. Additionally, empirical equations were used to calculate various constituent loads from the sampled storms. The results of the field sampling and the empirical equations were compared to water quality data obtained from sampling stations in the Salt River and Indian Bend Wash. A more detailed discussion of the methodology, results and recommendations is provided in Appendix B.

The results of the sampling and analysis did not identify acute water quality problems from the two precipitation events that were sampled. The calculated results from the empirical equations also did not indicate seriously elevated constituent loads for modeled stormwater runoff. These results, with limited exceptions compared favorably to the data obtained from the receiving areas (IBW and the Salt River). The study results appear to indicate that stormwater discharge from the study area is comparable to that found in the receiving water's discharge.

While overall results noted no acute water quality problems, some areas of potential concern were identified. Elevated oil and grease levels and total suspended solids (TSS) were noted at several locations, not only in the first-flush event but in the later sample. These elevated levels were primarily concentrated at Sites 1 and 2. It does not appear that these elevated levels are significantly affecting the receiving water (based on the limited existing data). However, chronic effects to the receiving waters and localized detrimental effects may occur as a result of these constituent loads. It is recommended that either site specific management controls or in stream collection devices be implemented to minimize the discharge of these constituents to downstream areas.

It should also be noted that this analysis may not be sufficient baseline data for an NPDES application and any such application would most likely require additional monitoring. Also, if the design is altered to include "natural treatment" systems, consideration should be given to additional sampling at the "natural treatment" system site.

Erosion and Sediment Control

The handling of sediment loads at inlets, sediment control in the basins, and erosion at outlets were considered qualitatively as part of the recommended plan.

Sediment loads at most inlets will not require special treatment since the inlet and tributary watershed areas are mostly urbanized. The inlets at Papago Park and the Arizona National Guard facility, however, will capture runoff from natural washes and will require special treatment. Design of sediment basins should be considered during final design for the Oak Street Outfall.

The basins in the recommended plan will experience low velocity flow and are not anticipated to have erosion problems. These low velocities, however, can cause sediment to settle out of the water column and accumulate in the basin. The District should anticipate maintenance requirements for the basins and should develop some specific maintenance strategies during final design. Preliminary layout of pre-treatment basins are already incorporated into the Marriott Basin and the Paiute Basin grading plans.

Erosive velocities at the outlets should be handled through the design of outlet structures which meet engineering standards for design. A budgetary allowance of $50,000 per outlet is included in the opinions of probable cost to account for this.

Maintenance of Traffic

During the Alternative Formulation phase of this project, it was determined that the major roadways with large volumes of traffic (McDowell Road, Thomas Road, Scottsdale Road) would be avoided as much as possible. The recommended plan reflects this decision since the alignments are primarily along Oak Street and Osborn Road. These roadways, however, still carry high traffic volumes and maintenance of traffic during construction will require special consideration during final design. Key issues are anticipated to include:

- Maintaining access to the Hy-View neighborhood during construction.
- Maintaining access to the Tonalea Elementary School and Coronado High School along Oak Street during construction.
- Maintaining access to the Scottsdale Municipal Hospital during construction.
- Avoiding construction in the vicinity of Scottsdale Municipal Stadium during the baseball season.
- Construction at the two crossings of Scottsdale Road and Civic Center Boulevard will require special consideration.
- Coordination between the 64th Street Projects and the STP Papago Project to identify opportunities for combining construction to reduce traffic maintenance concerns.
- Use of one-way traffic flow during construction where the alignment is near the center of the roadway.
- Use of non-rush hour or nightly construction in heavily congested areas.
- Closure of side streets where possible without eliminating access to neighborhoods.

Special Design Considerations

During the preliminary design of the recommended plan, the following special design considerations were identified.

Trenching Techniques

Since a majority of the construction will occur in rights of way occupied by numerous parallel utility lines and roadways with high volumes of traffic, construction techniques should be considered during final design. These preliminary plans were prepared based on the assumption that trench boxes would be incorporated into the design. This will help avoid parallel utilities falling into the trench and potentially reduce the pavement cut widths. The additional use of sheet piling or other vertical trenching techniques during construction should be considered during final design.

Pre-Cast Structures

Box Culverts, transition structures, and junction boxes are often built with cast-in-place construction. This requires several weeks of open trench while the forms are placed, reinforcement is built, concrete is poured, and the structure hardens and strengthens. Due to the safety and access issues associated with a wide open trench in an active roadway right of way, pre-cast structures should be considered during final design.

Pipe Plugs

Project phasing should be considered when plugging existing pipes. In particular, the McDowell Road cross culvert at the Scottsdale Auto Mall should not be plugged until the entire Oak Street Outfall is constructed to Indian Bend Wash. This culvert drains excess floodwaters in the Auto Mall Basin under existing conditions and cannot be abandoned until an alternate flow path is established.

Project Viability

Several issues regarding the expected pitfalls and opportunities to be considered for the recommended plan have been identified.

Oak Street Outfall

The Oak Street Outfall has been supported unanimously by the steering committee and received support at the public involvement meetings. There are two issues to consider.

- The Oak Street Outfall is designed with the intention of minimizing the impacts on the Scottsdale Auto Park basin, however, the basin has a history of flooding problems which have created an atmosphere of concern. The owners should be involved during the final design.

- The Arizona National Guard facility west of Papago Park is on property owned by the Bureau of Land Management. This includes the south ½ of the right of way between 58th Street and 60th Street which is affected by the recommended plan. The staff of the Arizona National Guard has indicated acceptance of the design concept during a coordination meeting. Both the Bureau of Land Management and the Arizona National Guard should be involved during final design.

Osborn Road Outfall

Project viability for the Osborn Road Outfall is contingent on the following.

- The proposed enlargement of Marriott's Brighton Gardens basin needs to be coordinated with the property owner during final design. The staff has indicated acceptance of the design concept during coordination meetings.

- Paiute Park is a City of Scottsdale Municipal Park leased from SRP. The City of Scottsdale staff has indicated acceptance of the shared use of Paiute Park for a detention basin. It is anticipated that SRP will be agreeable to the additional use since no stipulations for use are in the lease agreement. Both entities should be involved during the final design.

- No clear consensus was reached as to how best to use the existing storm drain in Osborn Road. This should be resolved as part of the final design effort for the Osborn Road Outfall.

- A diversion of runoff from the Arcadia Area is being considered by the City of Scottsdale. This was analyzed as part of this study and is reported under separate cover. This should be resolved as part of the final design effort for the Osborn Road Outfall.

Opinions of Probable Cost

The final area for evaluation of the recommended plan is the opinions of probable cost. The cost is only intended for budgetary purposes. A more detailed cost estimate should be prepared during final design. The contingency for these costs was determined based on bid tabulations for recent District projects, as provided by the District. A review of these bid tabulations revealed that the cost for a storm drain project is primarily found in the pipe costs, with the incidental costs not exceeding 10% of the total project cost. Engineering design and permitting costs are also estimated to be 10% of the total project cost. An additional contingency of 15% was added, totaling a 35% contingency for the opinions of probable cost. The results are shown in Table 3-3 and Table 3-4.

Table 3-3 Oak Street Outfall: Opinion of Probable Cost

Description	Quantity	Units	Rate	Amount
Dual 9.5' x 4.5' RCB (Table 1)	1,800	lf	$809.00	$1,456,200
Dual 7.0' x 4.5' RCB (Table 1)	2,245	lf	$593.00	$1,331,285
90" RGRCP	2,450	lf	$400.00	$980,000
75" RGRCP	500	lf	$280.00	$140,000
72" RGRCP	1,115	lf	$260.00	$289,900
66" RGRCP	1,690	lf	$250.00	$422,500
57" RGRCP	1,275	lf	$235.00	$299,625
36" RGRCP	3,600	lf	$145.00	$522,000
Special Design Junction Box	1	ea	$50,000.00	$50,000
Junction Boxes	25	ea	$20,000.00	$500,000
Transition Structures	6	ea	$20,000.00	$120,000
Manholes (24"-48")	10	ea	$3,000.00	$30,000
Inlet / Outlet Works	4	ea	$50,000.00	$200,000
Auto Park Basin Excavation	800	cy	$6.00	$4,800
Landscape Budget	1	ls	$50,000.00	$50,000
Subtotal Construction Costs				**$6,396,310**
AZ Guard Easement Costs	0.05	ac	$130,000.00	$6,500
Papago Park Easement Costs	0.03	ac	$130,000.00	$3,900
Auto Park Easement Costs	0.03	ac	$130,000.00	$3,900
Subtotal Acquisition Costs				**$14,300**
Utility Conflicts Budget				$853,205
Contingency @ 35%				$2,238,709
Total Opinion of Probable Cost				**$9,502,524**

Table 3-4 Osborn Road Outfall: Opinion of Probable Cost

Description	Quantity	Units	Rate	Amount
9.5' x 5.5' RCB (Table 1)	25	lf	$468.00	$11,700
9' x 5' RCB (Table 1)	100	lf	$433.00	$43,300
9' x 3' RCB (Table 1)	1,089	lf	$376.00	$409,464
8.5' x 3' RCB (Table 2)	31	lf	$351.00	$10,881
5' x 3.5' RCB (Table 2)	30	lf	$234.00	$7,020
4.5' x 3' RCB (Table 2)	34	lf	$185.00	$6,290
114" RGRCP	2,430	lf	$357.73	$869,284
96" RGRCP	1,252	lf	$254.55	$318,697
84" RGRCP	1,292	lf	$375.00	$484,500
72" RGRCP	900	lf	$300.00	$270,000
66" RGRCP	980	lf	$280.00	$274,400
60" RGRCP	1,105	lf	$250.00	$276,250
48" RGRCP	1,200	lf	$235.00	$282,000
42" RGRCP	524	lf	$175.00	$91,700
36" RGRCP	362	lf	$160.00	$57,920
Special Design Junction Box	1	ea	$50,000.00	$50,000
Junction Boxes	18	ea	$20,000.00	$360,000
Manholes	5	ea	$3,000.00	$15,000
Transition Structures	18	ea	$13,500.00	$243,000
Inlet / Outlet Works	3	ea	$50,000.00	$150,000
Paiute Park Basin Excavation	34,500	cy	$6.00	$207,000
3' Retaining Wall	1,520	lf	$75.00	$114,000
Landscape Budget	1	ls	$20,000.00	$20,000
Marriott Homes Basin Excavation	9,000	cy	$6.00	$54,000
Landscape Budget	1	ls	$20,000.00	$20,000
Subtotal Construction Costs				**$4,646,406**
Marriott Homes Easement Costs	2.30	ac	$240,000.00	$552,000
Paiute Park Easement Costs	4.80	ac	$175,000.00	$840,000
Catalina Drive Easement Costs	0.01	ac	$175,000.00	$1,750
Subtotal Acquisition Costs				**$1,393,750**
Utility Conflicts Budget				$520,619
Contingency @ 35%				$1,626,242
Total Opinion of Probable Cost				**$8,187,016**

4. Implementation Program

There are many keys to successful implementation of the recommended plan described above. They include securing funding, cost sharing, construction phasing, continued coordination with stakeholders, and taking advantage of other ongoing projects.

The District has already secured some funding for fiscal year 1997-98 with which to begin the final design of the recommended plan. The construction funding is anticipated to be made available in subsequent years.

Phasing Plan

Based on conversations with the steering committee and the District, a preliminary construction phasing plan has been prepared for consideration on this project. The plan prioritizes construction in areas where the drainage issues are most severe and reflects the budgetary constraints of the District.

Table 4-1 Construction Phasing Plan

Proposed Phasing		Description	Cost
		Oak Street Outfall	
Phase I	Entire	COS to construct Oak St. Outfall along 64th St., 66th St., and along Oak St., from 64th St. to 66th St. as part of the 64th St. project.	$2.2 million
Phase II	Priority 1	Construct Oak St. storm drain, from 66th St. to IBW.	$6.4 million
	Priority 2	Construct Oak St. storm drain, from 58th St. to 64th St.	$0.9 million
		Osborn Road Outfall	
Phase I	Entire	COS to construct 64th St. storm drain, from Catalina Dr. to Paiute Park as part of the 64th St. project.	$0.8 million
Phase II	Priority 1	Construct Osborn Rd. storm drain, from Paiute Basin to Scottsdale Road.	$4.1 million
	Priority 2	Construct Osborn Rd. storm drain, from Scottsdale Road to the existing storm drain at Miller Road.	$1.7 million
Phase III	Entire	Construct upper basin improvements from the Marriott Basin to 64th St.	$1.6 million
		Total Cost	**$17.7 million**

Coordination Issues

A significant amount of coordination was involved in finalizing the recommended plan. This coordination should continue to happen during final design. The following is a summary of the stakeholders and the coordination efforts already accomplished.

1. The District should continue to conduct coordination meetings with the City of Scottsdale and develop an intergovernmental agreement with the city which documents the shared responsibilities for implementation. The coordination should include responsibilities for submitting a CLOMR for the Hy-View neighborhood and coordination with the 64th Street Projects between McDowell Road and Indian School Road.

2. The District should continue to conduct coordination meetings with the City of Phoenix and develop an intergovernmental agreement with the city which documents the shared responsibilities for implementation.

3. The City of Tempe should also be considered for participation since the project eliminates the discharge under McDowell Road at the Cross Cut Canal and reduces the discharge and drainage area contributing to the City of Tempe storm drain.

4. The District should continue to hold coordination meetings with Salt River Project and develop a memorandum of understanding for placing storm drain under the Cross Cut Canal at Oak Street and Osborn Road and for using Paiute Park as a detention basin.

5. The District should meet with the other property owners affected by the project including the Bureau of Land Management, Scottsdale Auto Park, and Marriott's Brighton Gardens of Scottsdale to secure the necessary easements.

6. The District should meet with the utility owners sharing the rights of way to coordinate any required utility relocation, construction activities near their facilities, and any possible service interruptions during construction.

Appendix A - Data Collection

Appendix A - Data Collection

Purpose

This appendix describes the data collection effort undertaken as part of the watershed study for the STP Papago Regional Flood Control Project. Data collection was limited to data which is pertinent to the development of the study. Specific data collected is described in the following sections for Published Studies and Reports, Utility Information, As-Builts and Construction Plans, and Miscellaneous Information. This descriptions include contact names and organizations, data descriptions, and details regarding the nature of the data. A summary table of the data collection results is also provided.

Abbreviations

The following abbreviations are used in this report:

AASHTO	American Association of State Highway and Transportation Officials
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AICP	American Institute of Certified Planners
Ave.	Avenue
COE	Corps of Engineers
COP	City of Phoenix
COS	City of Scottsdale
COT	City of Tempe
FCDMC	Flood Control District of Maricopa County
FEMA	Federal Emergency Management Agency
GDM	General Design Memorandum
KHA	Kimley-Horn and Associates, Inc.
kV	Kilovolts
No.	Number
PERA	Project Employee Recreation Association
Pl.	Place
Prelim.	Preliminary
Rd.	Road
SRP	Salt River Project
St.	Street
STP	Scottsdale-Tempe-Phoenix
US	United States

Published Studies and Reports

There have been many studies and reports collected and reviewed for applicability to this project. They include studies and reports which address specific aspects of the study area such as drainage design reports, drainage studies, and flood insurance studies. They also include reports which provide design guidance for use in the watershed study.

Drainage Studies and Reports

Studies and reports which address specific aspects of the study area which were collected and reviewed are as follows:

1. AGK Engineers, Inc. Preliminary Drainage Design Report for 64th Street Improvements, McDowell Road to Thomas Road, January 1996.
2. Associated Engineers, Inc., Smittys #15 Drainage Report, July, 1976, revised December, 1976.
3. Boyle Engineering, Inc., City of Scottsdale Stormwater Master Plan and Management Program, Basin Reports, October 1993.
4. Brooks, Hersey and Associates, Inc., Drainage Report for Scottsdale Road Improvements, December 21, 1989.
5. Collar, Williams & White Engineering, Inc., Drainage Report for McDowell Road - 64th Street to Scottsdale Road, February 3, 1975.
6. David Evans and Associates, Inc., Final Drainage Report for Indian School Road Storm Drain, 64th Street to Hayden Road, November 1996.
7. Ellis-Murphy, Inc., Drainage Report for Scottsdale Road from McDowell Road to Osborn Road, October 1985.
8. Entellus, Final Drainage Report, 64th Street Improvements McDowell Rd to Thomas Rd, 1997.
9. Federal Emergency Management Agency, Flood Insurance Study, Maricopa County, Arizona and Incorporated Areas, Volumes 1, 2, 3, & 5 of 12, September 30, 1995.
10. GNE Associated, Drainage Report, Proposed Office Site located on the North Side of Thomas Road just West of Scottsdale Road, May 19, 1980.
11. Greiner, Inc., Design Report Addendum, Old Cross Cut Canal Flood Control Improvements, May 14, 1993.
12. Greiner, Inc., Old Cross Cut Canal Improvements Report, March 1991.
13. Hook, Rockwell and Associates, Hydraulic Report, Oak Street Storm Drain, March 21, 1975.
14. Johannessen & Girand Consulting Engineers, Inc., Drainage Design Report Addendum, Scottsdale Corporate Center by Hurst Inc., May 25, 1982.
15. Johannessen & Girand Consulting Engineers, Drainage Design, Scottsdale Corporate Center by Hurst Construction Co., October 12, 1981.
16. Johnson Brittain & Associates, Inc. Draft Drainage Design Report for Civic Center Plaza, Indian School Road to Fourth Street, June 7, 1985.
17. Parsons Brinckerhoff Quade & Douglas, Inc., Design Concept Report for 64th Street/ Indian School Road Design Concept Study, January 1994.

18. Parsons Brinckerhoff Quade & Douglas, Inc., Drainage Report for 64th Street/ Indian School Road Design Concept Study, September 1993.

19. Steele & Jensen, Inc., Drainage Study for Thomas Executive Center at 6908 East Thomas Road, September 30, 1983.

20. US COE, Design Memorandum No. 1, GDM - Phase I, Plan Formulation for Indian Bend Wash, October 23, 1973.

21. US COE, Design Memorandum No. 1, GDM - Phase I, Plan Formulation for Indian Bend Wash, Supplementary Report of Side Channels System, January 9, 1975.

22. US COE, Design Memorandum No. 1, GDM - Phase II, Project Design for Indian Bend Wash, May 16, 1975.

23. US COE, Design Memorandum No. 3, Feature Design for Inlet Channel, Project Design for Indian Bend Wash, January 31, 1978.

24. US COE, Design Memorandum No. 5, Feature Design for Side Channels System, Project Design for Indian Bend Wash, December 15, 1981.

25. US COE, Final Environmental Statement, Indian Bend Wash, Arizona, February 21, 1979.

26. US COE, Preliminary Flood Insurance Study, Scottsdale, Arizona, June 1972.

27. US Geological Survey, Open File Report 96-394, Physical, Chemical, Biological, and Toxicity Data from the Study of Urban Stormwater and Ephemeral Streams, Maricopa County, Arizona, Water Years 1992-95, 1996.

28. US Geological Survey, Water Resources Investigations Report 94-4240, Statistical Summary of Selected Physical, Chemical, and Microbial Characteristics, and Estimates of Constituent Loads in Urban Stormwater, Maricopa County, Arizona, 1995.

29. Water Resources Associates, Inc., A Drainage Study for a Proposed 7-Eleven Store to be Located on the Southwest Corner of 68th Street and Thomas Road, March 3, 1981.

Design Guidance Reports

Reports which were used as design guidance for the watershed study are as follows:

30. AASHTO, Policy on Geometric Design of Highways and Streets, 1990.

31. AASHTO, Roadside Design Guide, 1989.

32. Arizona Department of Transportation, Urban Highways, Channel Lining Design Guidelines, February 1989.

33. Arizona Department of Water Resources, Technical Study Documentation Notebook Standards, September 1991.

34. City of Scottsdale, Design Standards and Policies Manuals, September 1996.

35. Flood Control District of Maricopa County, Data Delivery Specifications, The Hydrologic Information System (H.I.S.), Rev. 2.0..

36. Flood Control District of Maricopa County, Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology.

37. Flood Control District of Maricopa County, Drainage Design Manual for Maricopa County, Arizona, Volume II, Hydraulics.

38. Flood Control District of Maricopa County, Drainage Design Manual for Maricopa County, Arizona, Volume III, Erosion Control.

39. Flood Control District of Maricopa County, Policy for the Aesthetic Treatment and Landscaping of Flood Control Projects, December 16, 1992.

40. US Department of the Army, Army Regulation 200-2: Environmental Effects of Army Actions, 1988.

41. US Geological Survey, Water-Supply Paper 2363, Techniques for Estimation of Storm-Runoff Loads, Volumes, and Selected Constituent Concentrations in Urban Watersheds in the United States, 1988.

Utility Information

There are many existing utilities which were considered for this watershed study. The following utility information and utility contact names were collected.

Arizona Public Service Co.

Steve Goodman	(602) 371-6965
Lois Winkler	(602) 371-6837

42. Electric Distribution System, Quarter Section Maps (T2N; R4E; Sections 26, 27)

43. Electric Distribution System, Section Maps (T2N; R4E; Sections 26, 27)

44. Interconnected Transmission System Map, 69kV and above

City of Phoenix

Gerald Arakaki	(602) 261-8229
Brian Butler	(602) 534-1961

45. Phoenix Engineering Department Storm Drain Maps, G-11, G-12 and H-11

46. Phoenix Wastewater Distribution System, Citywide

47. Phoenix Water Distribution System, Section Map 13-41 and 13-42

48. Phoenix Water Distribution System, Citywide

49. Phoenix Water System Sketches

City of Scottsdale

Larry Tritz	(602) 391-5631
Dave Meinhart	(602) 994-7010

50. Section Index Map, City of Scottsdale

51. Section Maps, Sewer System, 11-45 to 11-46; 12-43 to 12-46; 13-43 to 13-48; 14-41 to 14-48; 15-41 to 15-48; 16-42 to 16-48; 17-43 to 17-48; 18-43 to 18-48

52. Section Maps, Water Distribution System, 11-45 to 11-46; 12-43 to 12-46; 13-43 to 13-48; 14-41 to 14-48; 15-42 to 15-48, 16-42 to 16-48; 17-43 to 17-48; 18-43 to 18-48

City of Tempe

Tom Ankeny	(602) 350-8239

53. City Storm Drain Control Map (partial), July 1996

Cox Communications

Valerie Cross

54. Cable Television Distribution System - Quarter Section Maps, 11-40, 11-43, 11-44, 13-40, 14-40, 15-40 to 15-42, 16-40 to 16-42

Flood Insurance Rate Maps

Maricopa County, Arizona and Incorporated Areas

55. Map Number 04013C1695 F; Panel 1695 of 4350
56. Map Number 04013C2155 E; Panel 2155 of 4350
57. Map Number 04013C2160 D; Panel 2160 of 4350

Salt River Project, Electric

Silvia Alvarado (602) 236-0696
Russ Selbey (602) 236-8143

58. Metro Phoenix Joint Service Transmission System Map, for 69kV through 500 kV lines
59. Areawide Map, Fiber Optic Network ELI/SRP
60. ½ Township Maps, Buried Electrical Lines, Salt River Project
61. Acre Map, SRP Electric (T1N;R4E;Sections 3- (1 to 8))
62. Acre Map, SRP Electric (T1N;R4E;Sections 26-9; 27- (5,12,13); 28- (8,15,16))
63. Acre Map, SRP Electric (T1N;R4E;Sections 33- (1,2,4-12); 34- (1,4-8))
64. Acre Map, SRP Electric (T1N;R4E;Sections 34- (9-14); 35-(1,4-12))

Salt River Project, Water Engineering

Robert Mauer (602) 236-2962
Tom Sands (602) 236-2371

65. Plan and Profile, Arizona Canal Lateral 3.0 (T2N;R4E;S26)
66. Plan and Profile, Arizona Canal Lateral 4.6 E/W alignment along Osborn Road (T2N;R4E;S29)
67. Plan and Profile, Arizona Canal Lateral 4.7 (T2N;R4E;S20)
68. Plan and Profile, Arizona Canal Lateral 5.0 (T2N;R4E;S29)
69. Plan and Profile, Arizona Canal Lateral 6.0/6.1 N/S alignment along 48th Street McDowell to Indian School Road (T2N;R4E;S20,S30,S31)
70. Plan and Profile, Cross-Cut Canal Sump Pit (T2N;R4E;S27)
71. Plan and Profile, Drain Pipeline Along Indian School Road (T2N;R4E;S29)
72. Plan and Profile, Grand Canal Lateral 1.5 (T2N;R4E;S27)
73. Plan and Profile, Grand Canal Lateral 1.7 E/W alignment along Thomas Road (T2N;R4E;S28 to S29)
74. Plan and Profile, Grand Canal Lateral 2.0 N/S alignment along Cross Cut Canal (T2N;R4E;S34)
75. Plan and Profile, Grand Canal Lateral 2.4 E/W alignment along Oak Street (T2N;R4E;S34)

76. Plan and Profile, Grand Canal Lateral 3.0 (T1N;R4E;S2,3 and T2N;R4E;S34)
77. Plan and Profile, Grand Canal Lateral 3.4 (T1N;R4E;S3)
78. Plan and Profile, Grand Canal Lateral 3.5 (T1N,R4E;S3)
79. Plan and Profile, Grand Canal, Thomas Road and 64th Street Intersection (T2N;R4E;S29)
80. Plan and Profile, Indian Bend Pump Ditch. (T2N;R4E;S35)
81. Plan and Profile, Pump & Waste Ditch, Murray Lane. & Miller Road (T2N;R4E;S35)
82. Plan and Profile, Waste Ditch Along Osborn Road (T2N;R4E;S26)
83. Plan and Profile, Waste Ditch E/W alignment along Osborn Street & Earl Road (T2N;R4E;S29)
84. Profile, Arizona Canal, 48th Street & Indian School Road Intersection (T2N;R4E;S19)
85. Profile, Grand Canal, from Radial Gate 2-4.1 to Radial Gate 2-0.0
86. Profile; Waste Ditch (T1N;R4E;S2)
87. Conceptual Site Plans, SRP PERA Club, 3 plans
88. Topographic Map, SRP PERA Club, Sheets 1-5, Flown October 29, 1996
89. Zanjero Area Maps, Salt River Valley Water Users Association, 1994

Southwest Gas Corporation

Bob Sprague	(602) 484-5343
Ilaria Floris	(602) 484-5431

90. Sectional System Maps, 13-41 to 13-46; 14-41 to 14-46; 15-41 to 15-46; 16-41 to 16-46;
91. Township Maps, Southwest Gas, T2N;R4E; (SE,SW,NE,NW); T1N;R4E; (NE)

TCI Cable of Scottsdale

Harold Kronberg	(602) 314-5301

92. Sectional System Maps, 12-43 to 12-46; 13-43 to 13-46; 14-41 to 14-42; 15-41 to 15-46; 16-42 to 16-46;

US Geological Survey

93. 7.5' Quadrangle Maps

US WEST Communications

John Aker	(602) 630-0496
Chris Lertique	(602) 831-4771

94. Section Buried Facility Maps, US WEST, 9-45, 9-46; 10-44 to 10-46; 11-41 to 11-46; 12-43 to 12-46; 13-37 to 13-48; 14-37 to 14-48; 15-37 to 15-48; 16-37 to 16-48; 17-44 to 17-46

As-Builts and Construction Plans

Data collection for as-builts and construction plans was limited to large projects along a possible alternative alignment. In many cases, plans were obtained for projects with identified flooding concerns on or near the site. The following was collected:

95. Capital Improvements Engineering, Scottsdale Road Overlay Plans, Thomas Road to Greenway Road, Sheets 1-3 of 17
96. City of Phoenix, Paving Plans, Thomas Road, from 44th Street to 56th Street, Sheets 2-19, 30-59, 73-75, 77 of 107
97. City of Scottsdale, Eldorado Park North End, Plan As-Builts, Sheet 1 of 2
98. City of Scottsdale, Osborn Road Paving Plans, 70th Street to Scottsdale Road, Sheets 12-14 of 15
99. City of Scottsdale, Osborn Road Plans, near 68th Street, Sheets 17-18 of 22
100. City of Scottsdale, Paiute Park Site Inventory and Analysis, Conceptual Site Plan, October 20, 1995.
101. Coe & Van Loo Consulting Engineers, Inc., Osborn Road Paving Plans, Miller Road to Hayden Road, Sheets 1-5 of 5
102. Coe & Van Loo Consulting Engineers, Inc., Osborn Road Plans, East of Scottsdale Road, Sheet 6 of 22
103. Collar, Williams, & White Engineering, Inc., Osborn Road Improvement Plans, Cross Cut Canal to 328' East of 68th Street, Sheets 1-3 of 7
104. Comak Associated Engineers, Osborn Rd. Sewer Plan & Profile, Miller Road to Scottsdale Road, Sheets 9-12 of 15
105. Entellus, Preliminary Plans, 64th Street Road Improvements, McDowell Road to Thomas Road, Sheets 1-106 of 106
106. Ferguson, Morris & Associates, Inc., Scottsdale Road Improvement Plans, Osborn Road to Indian School Road, Sheets 1, 3-12, 21-27
107. Ferguson, Morris & Associates, Inc., Scottsdale Road Storm Drain Plans, Osborn Road to Indian Bend Wash, Sheets 1-23 of 23; Change Order #3 (Sheet 1 of 1)
108. Fusch-Serold & Partners AIA, Marriott Brighton Home Plan, Sheets A-1, C-1 to C-14, L-1 to L-4.
109. Greenly & Hansen, Water System Modifications- Contract No. 5 - System Separation, Sheets 1-5, 11 of 13
110. Greiner, Inc., Osborn Road Storm Drain As-Builts, Scottsdale Road to Indian Bend Wash, Sheets 1, 3-19, and 24 of 25
111. Hook, Rockwell & Associates, Oak Street Storm Drain As-Builts, 70th Street to Indian Bend Wash, Sheets 1, 4-14 of 14
112. McCausland & Pearce, Engrs., Roosevelt Road and 77th Street Paving Plans, Sheets 1-3 of 3
113. Parsons Brinckerhoff, 64th Street Improvements, 30% Plans, Geometric Plan & Data
114. Parsons Brinckerhoff, 64th Street Improvements, 95% Plans, Osborn Road to Stormdrain Outfall, Sheets 7 to 19 of 26

115. Robert S. Knight Engineers, Inc., Improvement District Plans, Osborn Road between Hinton Avenue and Miller Road, Miller Road between Osborn Road and East 2nd Street, Sheets 1-3 of 3

116. Toups Corporation, Paving As-Builts for Thomas Road and 74th Street Intersection, Sheet 1 of 1

117. Van Loo & Patel Consulting Engineers, Inc., Grading & Drainage Plans for Scottsdale Auto Park, Sheets 3 through 11

118. Williams & Ellis, Thomas Road Improvement Plans, 56th Street to Scottsdale Road, Sheets 2-3, 6-24 of 25

Miscellaneous Information

Other data collected for use in this watershed study which does not readily fit into any of the above categories is described in this section of the report.

Site Photographs

119. Photographs have been taken during the field visits conducted under the scope of this project.

Topographic Mapping

120. Topographic mapping for the City of Scottsdale, flown in September, October, and November, 1993, was obtained as both map and digital products for the study area.

Precipitation Data

121. ALERT System precipitation data was obtained in both hard copy and digital form.

Summary Table of Data Collection

The following table summarizes the data collection effort as described in the previous sections of this report. The categories for the table are described below.

Item No.

An item number was assigned to each item collected for use on the STP Papago Watershed Study. The item number will be noted on all data collected prior to filing. The data can then be easily found and used throughout the project. The item number may also be useful when discussing the data collection items.

Item Description

The description includes a summarized version of the name of the item. The full description may be found in the previous sections of the report.

Item Author

The item author is the person or company that is the author of the data.

Section No.

The section number corresponds to the section of the report in which the full description of the item can be found.

Item Media

The item media is the format on which the data can be found in the project files. The MAP, MISC, PLAN, and REPORT items can be found in the project files. The DIGITAL items can be found in the project directory on the computer network.

Item Source

The item source is the agency/ source of the data item.

Item No.	Item Description	Item Author	Section No.	Item Media	Item Source
1	Prelim. Drainage Design Report for 64th St. Improvements, McDowell Rd to Thomas Rd (1/96)	AGK Engineers, Inc.	3.0	REPORT	FCDMC
2	Smittys #15 Drainage Report (12/76)	Associated Engineers	3.0	REPORT	FCDMC
3	COS Stormwater Master Plan and Management Program, Basin Reports (10/93)	Boyle Engr., Inc.	3.0	REPORT	COS
4	Drainage Design Report for Scottsdale Rd. Improvements (12/21/89)	Brooks, Hersey, Assoc.	3.0	REPORT	COS
5	Drainage Report for McDowell Rd - 64th St. to Scottsdale Rd. (2/3/75)	Collar, Wllms, & White	3.0	REPORT	COS
6	Final Drainage Report, Indian School Road Storm Drain, 64th St. to Hayden Rd. (11/96)	David Evans & Assoc.	3.0	REPORT	COS
7	Drainage Report for Scottsdale Road from McDowell Rd. to Osborn Rd. (10/85)	Ellis-Murphy, Inc.	3.0	REPORT	COS
8	Final Drainage Report, 64th Street Improvements McDowell Rd to Thomas Rd (1997)	Entellus	3.0	REPORT	COS
9	Flood Insurance Study, Maricopa County and Incorporated Areas, Vol. 1,2,3 and 5 of 12	FEMA	3.0	REPORT	FCDMC
10	Drainage Report, Prop. Office on North Side of Thomas Rd., West of Scottsdale Rd. (5/19/80)	GNE Assoc.	3.0	REPORT	COS
11	Design Report Addendum, Old Cross Cut Canal Flood Control Improvements (5/14/93)	Greiner, Inc.	3.0	REPORT	FCDMC
12	Old Cross Cut Canal Improvements Report (3/91)	Greiner, Inc.	3.0	REPORT	FCDMC
13	Hydraulic Report: Oak St Storm Drain in Scottsdale, Az (3/21/75)	Hook, Rockwell, Assoc.	3.0	REPORT	COS
14	Drainage Design Report Addendum, Scottsdale Corporate Center (5/25/82)	Johannessen & Girand	3.0	REPORT	COS
15	Drainage Design, Scottsdale Corporate Center (10/12/81)	Johannessen & Girand	3.0	REPORT	COS
16	Draft Drainage Design Report, Civic Center Plaza, Indian School Rd. to 4th St. (6/7/85)	Johnson Brittain, Assoc.	3.0	REPORT	FCDMC
17	Design Concept Report for 64th St./ Indian School Rd. Design Concept Study (1/94)	Parsons Brinckerhoff	3.0	REPORT	COS
18	Drainage Report for 64th St./ Indian School Rd. Design Concept Study (9/93)	Parsons Brinckerhoff	3.0	REPORT	COS
19	Drainage Study for Thomas Executive Center at 6908 E. Thomas Rd. (9/30/83)	Steele & Jensen, Inc.	3.0	REPORT	COS
20	Design Memo. No. 1, GDM - Phase I, Plan Form. for Indian Bend Wash, (10/23/73)	US COE	3.0	REPORT	FCDMC
21	Design Memo. No. 1, GDM - Phase I, Plan Form. for Indian Bend Wash, Supp. Report on Side Channels (1/9/75)	US COE	3.0	REPORT	FCDMC
22	Design Memo. No. 1, GDM - Phase II, Project Design for Indian Bend Wash (5/16/75)	US COE	3.0	REPORT	FCDMC
23	Design Memo. No. 3, Feature Design for Inlet Channel, Indian Bend Wash (1/31/78)	US COE	3.0	REPORT	FCDMC
24	Design Memo. No. 5, Feature Design for Side Channels System, Indian Bend Wash (12/15/81)	US COE	3.0	REPORT	FCDMC
25	Final Envr. Statement, Indian Bend Wash, AZ (2/21/79)	US COE	3.0	REPORT	FCDMC
26	Preliminary Flood Insurance Study for Scottsdale, AZ (6/72)	US COE	3.0	REPORT	FCDMC
27	Physical, Chem, Bio, and Toxicity Data from ... Streams, Maricopa Cnty, Water Years 1992-95	USGS	3.0	REPORT	KHA
28	Statistical Summary of Selctd Phys, Chem, and Microbial Char ... in Stormwater, Maricopa Cnty	USGS	3.0	REPORT	KHA
29	Drainage Study for Prop. 7-11 to be located on SW Corner of 68th St. & Thomas Rd. (2/24/81)	Water Resource Assoc.	3.0	REPORT	COS
30	Policy on Geometric Design of Highways and Streets, 1990	AASHTO	3.0	REPORT	KHA
31	Roadside Design Guide, 1989	AASHTO	3.0	REPORT	KHA
32	Urban Highways, Channel Lining Design Guidelines (2/89)	ADOT	3.0	REPORT	KHA
33	Technical Study Documentation Notebook Standards (9/91)	ADWR	3.0	REPORT	KHA
34	City of Scottsdale, Design Standards and Policies Manual (9/96)	COS	3.0	REPORT	KHA
35	Data Delivery Specifications: Hydrologic Information System (H.I.S.), Rev. 2.0	FCDMC	3.0	REPORT	FCDMC
36	Drainage Design Manual for Maricopa County, Volume I, Hydrology	FCDMC	3.0	REPORT	FCDMC
37	Drainage Design Manual for Maricopa County, Volume II, Hydraulics	FCDMC	3.0	REPORT	FCDMC
38	Drainage Design Manual for Maricopa County, Volume III, Erosion Control	FCDMC	3.0	REPORT	FCDMC
39	Policy for Aesthetic Treatment and Landscaping of Flood Control Projects	FCDMC	3.0	REPORT	FCDMC
40	Army Regulation 200-2: Environmental Effects of Army Actions	US Dept. of the Army	3.0	REPORT	ARNG
41	Techniques for Estimation of Storm-Runoff Loads Vol... Consitiuent Conc. in Urban Watersheds	USGS	3.0	REPORT	KHA

Item No.	Item Description	Item Author	Section No.	Item Media	Item Source
42	APS - Electric Distrubution System - 1/4 Section maps T2N, R4E, S(26,27)	APS	4.0	MAP	APS
43	APS - Electric Distrubution System - Section maps T2N, R4E, S(26, 27)	APS	4.0	MAP	APS
44	APS - Transmission System, 69kV and Above	APS	4.0	MAP	APS
45	Phoenix Storm Drain Maps, H-11, G-11, G-12	COP	4.0	MAP	COP
46	Phoenix Wastewater System Map, Citywide	COP	4.0	MAP	COP
47	Phoenix Water System Map, 13-41 & 13-42	COP	4.0	MAP	COP
48	Phoenix Water System Map, Citywide	COP	4.0	MAP	COP
49	Phoenix Water System Sketches	COP	4.0	PLAN	COP
50	Scottsdale Quarter Section Index Map, Citywide	COS	4.0	MAP	COS
51	Scottsdale Sewer System Maps, 11-45 to 11-46; 12-43 to 12-46; 13-43 to 13-48; 14-41 to 14-48	COS	4.0	MAP	COS
	Scottsdale Sewer System Maps, 15-41 to 15-48; 16-42 to 16-48; 17-43 to 17-48; 18-43 to 18-48	COS	4.0	MAP	COS
52	Scottsdale Water System Maps, 11-45 to 11-46; 12-43 to 12-46; 13-43 to 13-48; 14-41 to 14-48	COS	4.0	MAP	COS
	Scottsdale Water System Maps, 15-42 to 15-48; 16-42 to 16-48; 17-43 to 17-48; 18-43 to 18-48	COS	4.0	MAP	COS
53	City of Tempe Storm Drain Map, partial	COT	4.0	MAP	COT
54	COX - Cable Television Distribution - Quarter Section Maps, 11-40, 11-43, 11-44, 13-40, 14-40, 15-40 to 15-42, 16-40	COX	4.0	MAP	COX
55	FEMA Flood Insurance Rate Maps, Maps - 04013C1695 F	FEMA	4.0	MAP	FCDMC
56	FEMA Flood Insurance Rate Maps, Maps - 04013C2155 E	FEMA	4.0	MAP	FCDMC
57	FEMA Flood Insurance Rate Maps, Maps - 04013C2160 D	FEMA	4.0	MAP	FCDMC
58	Metro Phoenix Joint Service Transmission System, 69kV through 500kV	SRP-ELEC	4.0	MAP	SRP-ELEC
59	SRP - Fiber Optic Network ELI/SRP, Areawide	SRP-ELEC	4.0	MAP	SRP-ELEC
60	SRP - Underground Electric - 1/2 Township Maps (2 Total)	SRP-ELEC	4.0	MAP	SRP-ELEC
61	SRP - Underground Electric - 40 ac. maps T1N, R4E, Sects. 3-(1 to 8)	SRP-ELEC	4.0	MAP	SRP-ELEC
62	SRP - Underground Electric - 40 ac. maps T1N, R4E, Sects. 26-9; 27-(5,12,13); 28-(8,15,16)	SRP-ELEC	4.0	MAP	SRP-ELEC
63	SRP - Underground Electric - 40 ac. maps T2N, R4E, Sects. 33-(1,2,4-12); 34-(1, 4-8)	SRP-ELEC	4.0	MAP	SRP-ELEC
64	SRP - Underground Electric - 40 ac. maps T2N, R4E, Sects. 34-(9-14); 35-(1,4-12)	SRP-ELEC	4.0	MAP	SRP-ELEC
65	Plan and Profile, Arizona Canal Lateral 3.0 (T2N;R4E;S26)	SRP-WATER	4.0	PLAN	SRP-WATER
66	Plan and Profile, Arizona Canal Lateral 4.6 E/W alignment along Osborn Rd. (T2N;R4E;S29)	SRP-WATER	4.0	PLAN	SRP-WATER
67	Plan and Profile, Arizona Canal Lateral 4.7 (T2N;R4E;S20)	SRP-WATER	4.0	PLAN	SRP-WATER
68	Plan and Profile, Arizona Canal Lateral 5.0 (T2N;R4E;S29)	SRP-WATER	4.0	PLAN	SRP-WATER
69	Plan and Profile, Arizona Canal Lateral 6.0/6.1 N/S alignment along 48th St. McDowell to Indian School (T2N;R4E;S2	SRP-WATER	4.0	PLAN	SRP-WATER
70	Plan and Profile, Cross-Cut Canal Sump Pit (T2N;R4E;S27)	SRP-WATER	4.0	PLAN	SRP-WATER
71	Plan and Profile, Drain Pipeline Along Indian School Rd. (T2N;R4E;S29)	SRP-WATER	4.0	PLAN	SRP-WATER
72	Plan and Profile, Grand Canal Lateral 1.5 (T2N;R4E;S27)	SRP-WATER	4.0	PLAN	SRP-WATER
73	Plan and Profile, Grand Canal Lateral 1.7 E/W alignment along Thomas Rd. (T2N;R4E;S28 to S29)	SRP-WATER	4.0	PLAN	SRP-WATER
74	Plan and Profile, Grand Canal Lateral 2.0 N/S alignment along Cross Cut Canal (T2N;R4E;S34)	SRP-WATER	4.0	PLAN	SRP-WATER
75	Plan and Profile, Grand Canal Lateral 2.4 E/W alignment along Oak St. (T2N;R4E;S34)	SRP-WATER	4.0	PLAN	SRP-WATER
76	Plan and Profile, Grand Canal Lateral 3.0 (T1N;R4E;S2,3 and T2N;R4E;S34)	SRP-WATER	4.0	PLAN	SRP-WATER
77	Plan and Profile, Grand Canal Lateral 3.4 (T1N;R4E;S3)	SRP-WATER	4.0	PLAN	SRP-WATER
78	Plan and Profile, Grand Canal Lateral 3.5 (T1N,R4E;S3)	SRP-WATER	4.0	PLAN	SRP-WATER
79	Plan and Profile, Grand Canal, Thomas Rd. and 64th St. Intersection (T2N;R4E;S29)	SRP-WATER	4.0	PLAN	SRP-WATER
80	Plan and Profile, Indian Bend Pump Ditch. (T2N;R4E;S35)	SRP-WATER	4.0	PLAN	SRP-WATER
81	Plan and Profile, Pump & Waste Ditch, Murray Ln. & Miller Rd. (T2N;R4E;S35)	SRP-WATER	4.0	PLAN	SRP-WATER

Item No.	Item Description	Item Author	Section No.	Item Media	Item Source
82	Plan and Profile, Waste Ditch Along Osborn Rd (T2N;R4E;S26)	SRP-WATER	4.0	PLAN	SRP-WATER
83	Plan and Profile, Waste Ditch E/W alignment along Osborn & Earl (T2N;R4E;S29)	SRP-WATER	4.0	PLAN	SRP-WATER
84	Profile, Arizona Canal, 48th St. & Indian School Rd Intersection (T2N;R4E;S19)	SRP-WATER	4.0	PLAN	SRP-WATER
85	Profile, Grand Canal, from Radial Gate 2-4.1 to Radial Gate 2-0.0	SRP-WATER	4.0	PLAN	SRP-WATER
86	Profile; Waste Ditch (T1N;R4E;S2)	SRP-WATER	4.0	PLAN	SRP-WATER
87	SRP - 3 Maps of the PERA Club - Maint. Yard; 2 Layout Plans for Site	SRP-WATER	4.0	MAP	SRP-WATER
88	SRP - PERA Club Topography (Flown 10/29/96) - Sheets 1 through 5	SRP-WATER	4.0	MAP	SRP-WATER
89	Zanjero Area Maps, Salt River Valley Water Users Association, 1994	SRP-WATER	4.0	MAP	SRP-WATER
90	Southwest Gas - 1/4 Section maps - 13-41 to 13-46; 14-41 to 14-46; 15-41 to 15-46; 16-41 to 16-46	SWG	4.0	MAP	SWG
91	Southwest Gas - 1/4 Township maps - T2N,R4E,(SE,SW,NE,NW); T1N,R4E,(NE only)	SWG	4.0	MAP	SWG
92	TCI Cable - 12-43 to 12-46; 13-43 to 13-46; 14-41 to 14-42	TCI	4.0	MAP	TCI
	TCI Cable - 15-41 to 15-46; 16-42 to 16-46	TCI	4.0	MAP	TCI
93	USGS 7.5 minute Quadrangle Maps	USGS	4.0	MAP	USGS
94	US West - 9-45, 9-46; 10-44 to 10-46; 11-41 to 11-46; 12-43 to 12-46; 13-37 to 13-48	USWEST	4.0	MAP	USWEST
	US West - 14-37 to 14-48; 15-37 to 15-48; 16-37 to 16-48; 17-44 to 17-46	USWEST	4.0	MAP	USWEST
95	Scottsdale Rd. Overlay Plans, Thomas Rd. to Greenway Rd., Sheets 1-3 of 17	Capital Imprvmnts Engr	5.0	PLAN	COS
96	Paving Plans, Thomas Rd., 44th St. to 56th St., Sheets 2-19, 30-59, 73-75, 77 of 107	City of Phoenix	5.0	PLAN	COP
97	Eldorado Park North End- Plan As Built - Sheet 1 of 2	City of Scottsdale	5.0	PLAN	COS
98	Osborn Rd. Paving Plans, 70th St. to Scottsdale Rd., Sheets 12-14 of 15	City of Scottsdale	5.0	PLAN	COS
99	Osborn Rd. Plans, near 68th St., Sheets 17-18 of 22	City of Scottsdale	5.0	PLAN	COS
100	Paiute Park- Site Inventory & Analysis, Conceptual Site Plan- Oct. 20, 1995	City of Scottsdale	5.0	PLAN	COS
101	Osborn Rd. Paving Plans, Miller Rd. to Hayden Rd., Sheets 1-5 of 5	Coe & Van Loo	5.0	PLAN	COS
102	Osborn Rd. Plans, East of Scottsdale Rd., Sheet 6 of 22	Coe & Van Loo	5.0	PLAN	COS
103	Osborn Rd. Improvement Plans, Cross Cut Canal to 68th St., Sheets 1-3 of 7	Collar, Wllms, & White	5.0	PLAN	COS
104	Osborn Rd. Sewer Plan & Profile, Miller Rd. to Scottsdale Rd., Sheets 9-12 of 15	Cornak Associated Engnrs	5.0	PLAN	COS
105	64th St. Improvements, Preliminary Plans, McDowell Rd. to Thomas Rd, Sheets 1-106 of 106	Entellus	5.0	PLAN	COS
106	Scottsdale Rd. Improvement Plans, Osborn Rd. to Indian School Rd., Sheets 1,3-12,21-27	Ferguson, Morris, Assoc.	5.0	PLAN	COS
107	Scottsdale Rd. Strom Drain Plans, Osborn Rd. to Indian Bend Wash, Sheets 1-23 of 23, CO #3	Ferguson, Morris, Assoc.	5.0	PLAN	COS
108	Marriott Brighton Gardens Home Plan, Sheets A-1, C-1 to C-14, L1 to L4	Fusch-Serold & Partners A	5.0	PLAN	Marriott Home
109	Water System Modifications- Contract No. 5 - System Separation, Sheets 1-5, 11 of 13	Greenly & Hansen	5.0	PLAN	COS
110	Osborn Rd. Storm Drain Plans, Scottsdale Rd. to Indian Bend Wash, Sheets 1, 3-19, 24 of 25	Greiner, Inc.	5.0	PLAN	COS
111	Oak St. Storm Drain As-Builts, 70th St. to Indian Bend Wash, Sheets 1, 4-14 of 14	Hook, Rckwll, & Assoc.	5.0	PLAN	COS
112	Roosevelt Rd. and 77th St. Paving Plans, Sheets 1-3 of 3	McCausland & Pearce	5.0	PLAN	COS
113	64th St. Improvements, 30% Plans, Geometric Plan and Data	Parsons Brinckerhoff	5.0	PLAN	PB
114	64th St. Improvements, 95% Plans, Osborn Rd. Stormdrain Outfall, Sheets 7-19 of 26	Parsons Brinckerhoff	5.0	PLAN	PB
115	Improvement District Plans, near intersection of Osborn Rd. and Miller Rd., Sheets 1-3 of 3	Robert S. Knight Engr.	5.0	PLAN	COS
116	Paving As-Builts for Thomas Rd. and 74th St. Intersection, Sheet 1 of 1	Toups Corp.	5.0	PLAN	COS
117	Grading & Drainage Plans for Scottsdale Auto Park, Sheets 3 -11	Van Loo & Patel	5.0	PLAN	COS
118	Thomas Rd. Improvement Plans, 56th St. to Scottsdale Rd., Sheets 2-3, 6-24 of 25	Williams & Ellis	5.0	PLAN	COS
119	STP Papago Photographs from Field Visits	KHA	6.0	MISC	KHA
120	Topographic Mapping for COS, Fall 1993	COS	6.0	DIGITAL	FCDMC
121	ALERT System Precipitation Data	KHA	6.0	DIGITAL	KHA

Appendix B - Water Quality

Appendix B - Water Quality

Introduction

The project authorized by the Flood Control District of Maricopa County (FCDMC) is located within the metro-Phoenix area of south-central Arizona (See Figure 1). The STP Papago Regional Flood Control Project was implemented to evaluate planning alternatives and make a final plan recommendation to address lower frequency flooding problems in portions of the study area and to reduce or eliminate the floodplain along the west side of the Cross-Cut Canal. The study area is located in a portion of the Cities of Phoenix and Scottsdale and is adjacent to the City of Tempe. The study area is bounded to the north by the Arizona Canal and Camelback Road and to the east by Indian Bend Wash (IBW). The western boundary is formed by 56th Street and the southern limits of the study area is McKellips Road and Roosevelt Street (See Figure 2).

An important consideration for this project is the potential effect of stormwater discharge from the study area on receiving water quality. Therefore, a portion of the study was designed to estimate stormwater quality in the study area and to attempt to identify areas that might potentially affect stormwater quality. This report details the rationale, methodology, and results of the stormwater quality evaluation effort for this project.

Methodology

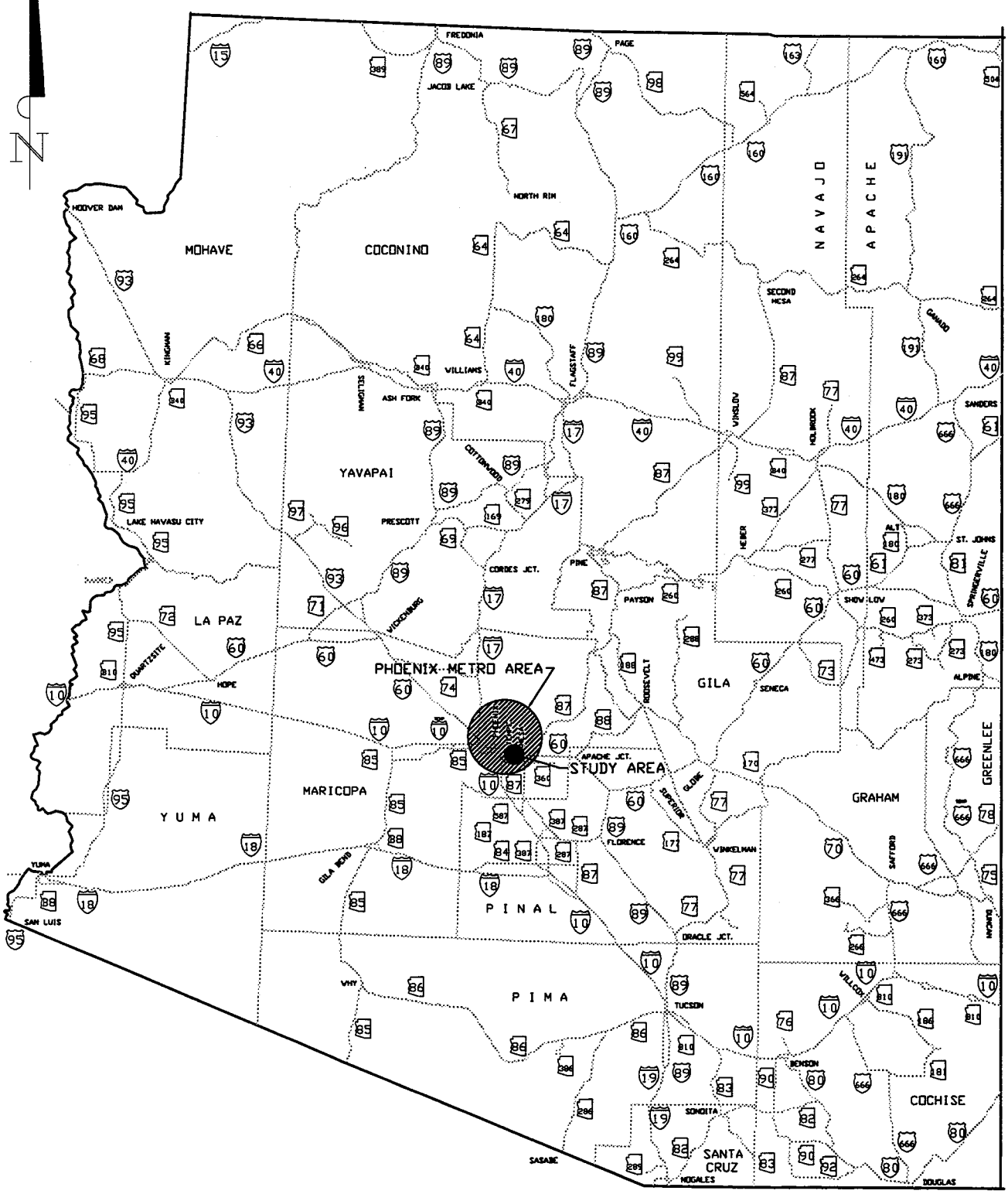
The purpose of the stormwater quality testing program was to conduct a general review of the study area's stormwater quality. The study was designed to evaluate stormwater discharges for the potential of unacceptable levels of particular stormwater runoff constituents. Climatic conditions and budget constraints prevented a large scale sampling and analysis program. Therefore, a combination program of limited sampling and empirical analysis was developed that also relied on existing data.

It is important to note that the stormwater quality analysis program was not intended to establish that the study area was free from potential contaminants. The limited number of sampling sites and the limited number of precipitation events sampled preclude that level of statistical certainty. It is doubtful that any sampling regime, unless it was continuous, would yield data complete enough to establish that level of detail. Instead, this study was designed to sample and analyze stormwater runoff from pre-determined sites in an attempt to analyze areas that had been deemed more likely to manifest a constituent discharge. Existing land use and discharge site land use was considered in the analysis. Also, the study was designed to aid in identifying constituent levels that might impact "natural treatment" systems proposed in the initial stages of the project.

The study protocol was designed to collect limited sampling data and supplement it with data derived from existing empirical equations. The sample data, the derived constituents' load estimates, and existing water quality data from several water quality stations were combined to evaluate the stormwater quality in the study area. A more detailed explanation of the three principal data sources is included below.

Existing Water Quality Data

The Water Resources Division of the United States Geological Survey (USGS) and the Maricopa County ALERT System maintain and monitor a series of water quality gauging stations and precipitation gauges throughout the Metro-Phoenix area. Existing water quality data was gathered from the USGS stations at Indian Bend Wash and Curry Road (USGS Station Number 09512162) and at several other stations along the Salt River, including a station located at Salt River/Priest Road (USGS Station Number 09512165). Precipitation data was gathered from the Alert Stations (4610 IBW at Indian Bend Road, 4620 IBW Interceptor Channel southwest of Indian Bend Road and Pima, and 4600 Indian Bend Wash - 0.25 miles south of McKellips Road).



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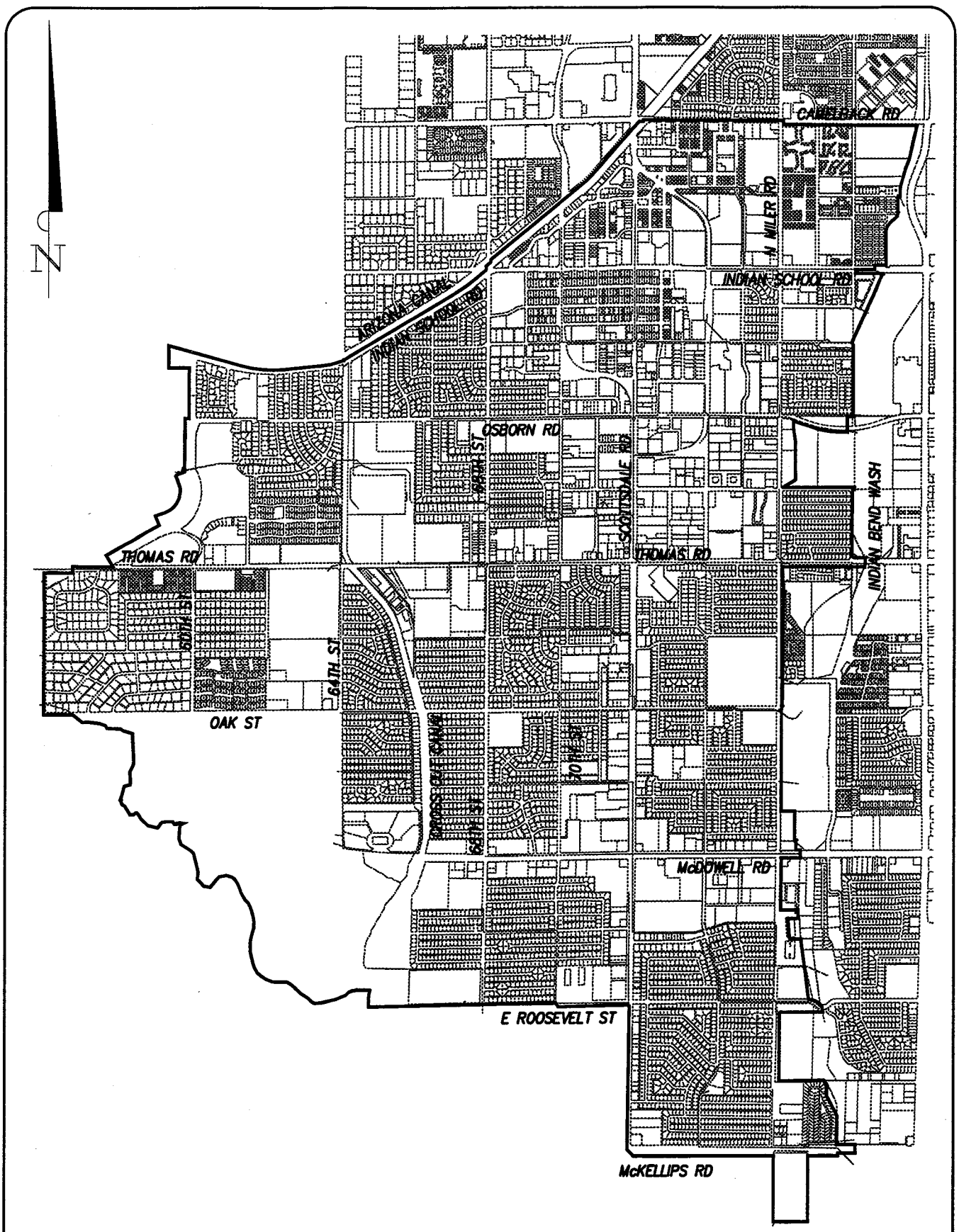
STP–PAPAGO
VICINITY MAP
FIGURE 1

SCALE: N.T.S.



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STP–PAPAGO
STUDY AREA
FIGURE 2

SCALE: N.T.S.

A summary of some of this data is contained in *USGS Water-Resources Investigations Report 94-4240 - Statistical Summary of Selected Physical, Chemical, and Microbial Characteristics, and Estimates of Constituent Loads in Urban Stormwater, Maricopa County, Arizona.* Additional data was obtained from *USGS Open File Report #96-394 - Physical, Chemical, Biological, and Toxicity Data from the Study of Urban Stormwater and Ephemeral Streams, Maricopa County, Arizona, Water Years 1992-95.* These reports were prepared with the co-operation of the Flood Control District of Maricopa County.

The precipitation data was used as a variable in the empirical equations. The introduction of this variable allowed the constituent load estimate from the equation to be related to the specific precipitation event. Existing water quality data from USGS stations was used as an indicator of baseline conditions and as a comparison to sampling and empirical data. The constituent load and storm runoff, both calculated by empirical equations, were used to calculate the constituent concentrations in the discharge waters.

There are certain limitations to using multiple water quality data for comparisons. The USGS and Maricopa County data represent stormwater quality measures taken primarily in or at outfalls to either Indian Bend Wash or the Salt River. Other areas of influence other than the study area can be contributing to the constituent loads in these flows. Additionally, portions of the study area do not discharge to IBW and, therefore, that discharge's constituent load is not represented in the existing data from the IBW station. Sites 1 and 2 do not discharge to IBW but ultimately to the Salt River; therefore, data from several water quality analysis stations further downstream on the Salt River were also compared to sampling data at Sites 1 and 2. There are also limitations in converting constituent load numbers (from the empirical equations) to concentrations. These issues are discussed further in the Empirical Data section of this report.

Sampling and Analysis

Sample sites were chosen based on numerous criteria including existing water quality data, public and agency identified concerns, sampling logistics, land use patterns (both existing and proposed) and sub-basin location and configuration. Three possible sampling regimes were identified that included six sites within or adjacent to the study area. These six sites are noted on Figure 3. The three proposed sampling regimes are included at the end of this appendix.

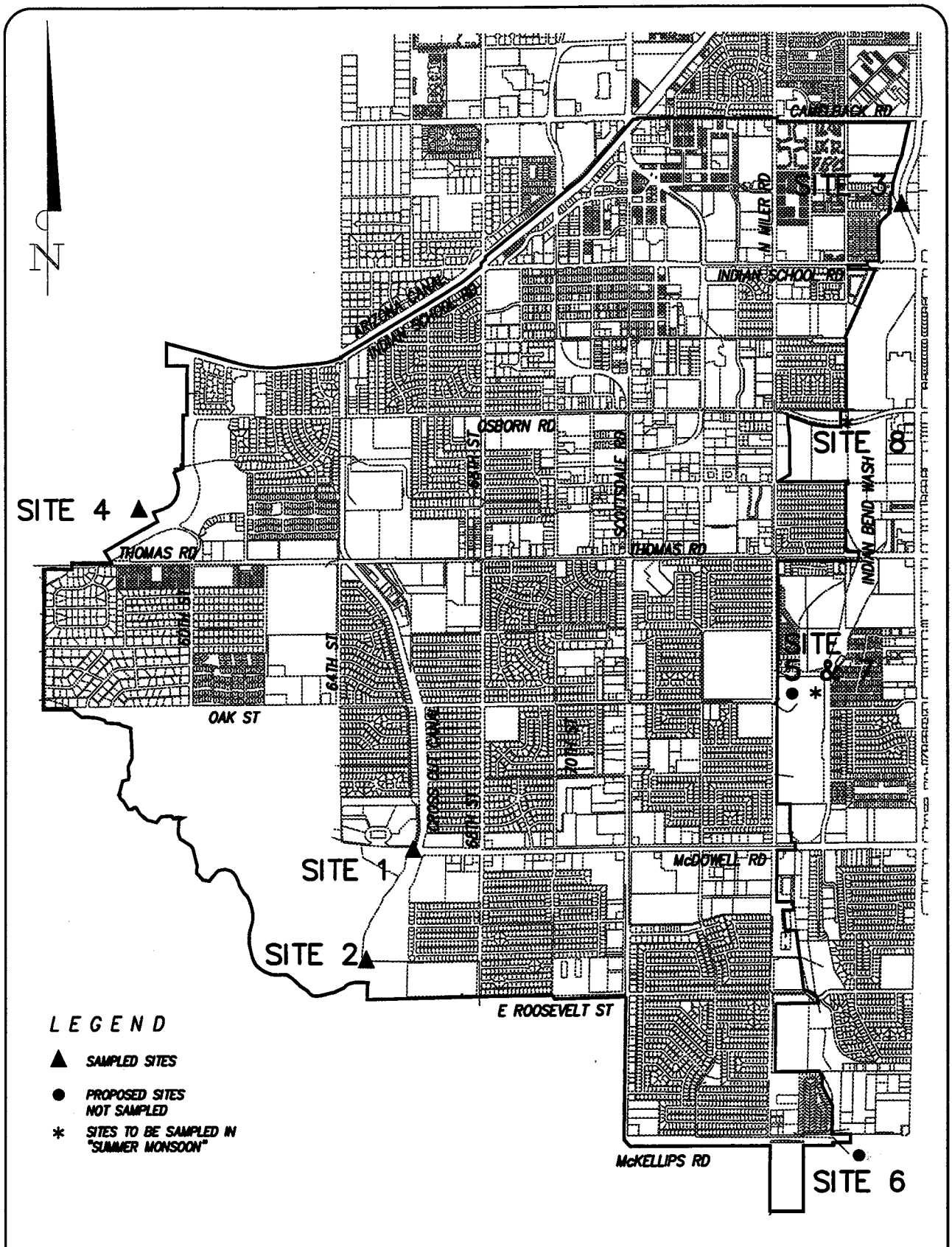
The recommended sampling regime was selected as the approved method and is described below. This regime was subsequently modified in response to changes in the proposed study alternatives and to address issues identified during the early phases of the analysis. The modifications are discussed later in this section.

Recommended Regime

Four sites were initially identified for sampling and limited analysis (See Figure 3) :

- Site 1 at the inlet of a 48-inch corrugated metal pipe (CMP) crossing McDowell Road immediately west of the Cross-Cut Canal.
- Site 2 at the discharge of a 30-inch reinforced concrete pipe (RCP) crossing the Cross-Cut Canal on the PERA Club site.
- Site 3 at a pipe outlet at the east end of 2nd Street where it outfalls into the golf course on Indian Bend Wash (IBW).
- Site 4 at a box culvert at 48th Street and Earl Road (discharge point is outside of the study area, but the basin is within study area).

The regime sampled two winter/spring precipitation events at the above listed sites. Each precipitation event was sampled twice: once during the first hour of the event (a first-flush sample) and another sample later in the event. Flow volumes were not used to determine if an event had reached significant levels to allow accumulated dust and sediment to be suspended in the discharge system.



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STP–PAPAGO

SAMPLING LOCATION/STUDY AREA

FIGURE 3

SCALE: N.T.S.

The extremely limited potential for precipitation events required that all events regardless of flow volume be sampled. If the precipitation and subsequent runoff event was of insufficient duration to provide a second sample, another event was sampled. The timing of this sample was such to provide for a non-first flush sample.

All sampling was conducted as per the National Pollutant Discharge Elimination System (NPDES) methodology outlined in the publication *NPDES Stormwater Sampling Guidance Document* (USEPA; July, 1992). Samples were labeled and followed a proper chain-of-custody protocol from sampling site to the analysis laboratory. The chain-of-custody paperwork is included at the end of this appendix.

The analysis regime was developed to provide the most accurate and complete measure of stormwater quality within the logistic constraints of the project. Based on the land use in the area of Sites 1 and 2 and on the sensitivity of the land uses in the discharge areas, it was determined that Sites 1 and 2 were deemed more sensitive to associated water quality issues than many of the other discharge sites. Therefore, these two sites were analyzed for a broader range of constituents to determine if the sub-basins might be contributing any of the analyzed constituents to the discharge areas. The broader analysis regime was conducted on the first-flush sample of the first precipitation event, as it was considered to be most likely the "worst-case" as far as constituent load is concerned.

The analysis conducted was chosen based on specific parameters of each sub-basin. Surface runoff from the first precipitation event at Sites 1 and 2 were analyzed for the "standard NPDES suite" that includes the following constituents (the additional sites, Sites 7 and 8, were sampled during a summer monsoon event and were analyzed for the constituents listed below):

- Volatile organics (EPA method 624),
- Semi-volatile organics (EPA method 625),
- Cyanide (EPA method SM4500-CN),
- Pesticides (EPA method 608),
- Priority metals (EPA methods 6010A and 7470 (lead)),
- Oil and grease (EPA method 413.1),
- Anions (sulfate, nitrate and nitrite, phosphorous - EPA method 300.0),
- Total Suspended Solids (EPA method 160.2),
- Chemical Oxygen Demand (EPA 410.4),
- Fecal coliform MPN (EPA method SM18-92221C).

Some of the constituents in this analysis, such as organochlorine pesticides, semi-volatile compounds, and volatile organic compounds, are not normally associated with urban and residential stormwater runoff. However, past land usage, such as agricultural activity, may have left residual levels of pesticides in the area. Semi-volatile and volatile organic compounds (such as constituents of diesel fuel and gasoline products that might likely be present given the land use) were included in the testing to establish that the analyzed water stream was free from detectable levels of contaminants (at least at the moment of sampling).

A reduced analysis group was conducted on Sites 3 and 4 for the first precipitation event. The reduced regime analysis included oil and grease, total suspended solids, priority metals, fecal coliform, and chemical oxygen demand. All four sites were sampled based on the reduced regime for the second precipitation event. Sampling protocol of a first flush and a second sample was maintained.

As the project progressed, it was recognized that the alternative analysis indicated two additional sampling sites might be required at the Oak Street outfall to Indian Bend Wash (Site 7) and Osborn Road outfall to Indian Bend Wash (Site 8). These two sites were sampled once during a summer monsoon event for a "Full NPDES Suite" (as described previously). Sampling methodologies and protocols (with the exception of a single sample at these sites instead of two samples at the other sites) were as described previously.

Empirical Data

In addition to the limited sampling, stormwater constituent loads were estimated using existing empirical equations. These equations were developed in 1988 by the USGS to estimate storm runoff constituent loads and stormwater volumes. The methodology employed in the development of these equations is detailed *in USGS Report 88-191 - Techniques For Estimation of Storm-Runoff Loads, Volumes, and Selected Constituent Concentrations In Urban Watersheds in the United States*. The study divides the Continental United States into three regions, with Phoenix being located in the most arid region, denoted as Region 1. Several sets of equations were developed based on physical, land use and climatic variables. Equations were developed to estimate constituent loads, seasonal or mean annual constituent loads and mean constituent loads for stormwater runoff. The equations also estimated storm runoff.

These regression equations were further modified in USGS Water-Resources Investigations Report 94-4240 (See Existing Data section). This report utilized the methodology detailed in Open File Report 88-191 along with sample data detailed in USGS Open File Report 96-394, specific to Maricopa County to develop coefficients for the constituent load regression equations. The study determined that the regression equations that estimated constituent loading from individual storms were the most statistically significant.

The equations, as developed in USGS Water-Resources Investigations Report 94-4240, have variables for total storm rainfall, drainage area, impervious area, percent of industrial land use, percent of commercial land use, percent of undeveloped land use, storm intensity, mean annual rainfall, and three adjustment co-efficients. Depending on the constituent being estimated, the specific equation may not utilize all of the variables. The majority of the constituents equations have three explanatory variables (drainage area, total rainfall, and percentage of impervious area). The standard errors for each constituent equation ranged from 65 to 266 percent. The equations and applicable variables are presented in Table 1.

Each of the sampled winter/spring precipitation events were modeled, using the empirical equations based on the amount of rainfall noted in the nearest precipitation gauge. When it was not clear which precipitation gauge best represented the discharge point both gauge values were used and the "worst-case" (highest load) result was utilized in the comparison. Numerous discharge points within the study area were modeled (See Figure 4). The results of the modeling of discharge points that coincide with the sample points were compared to the sample analysis results and existing water quality data at the USGS station(s).

The results of the empirical model are for specific storm constituent loads and are presented in pounds. In order to aid in comparison of this data with the existing water quality data from the USGS gauging stations and with the analysis data, an approximation of concentration was calculated from the total storm load. This was done by dividing the constituent load by the calculated volume of the storm. No adjustment was made for the potential for higher concentration early in the runoff event or reduced concentrations of various constituents in the lower velocity flows normally exhibited at the end of an event. Therefore, the results are for comparison only and are not necessarily an accurate measure of concentrations at a specific point in time for the runoff event.

Sampling and Modeling Results

The results of the model run on numerous discharge points within the study area are included at the end of this appendix. The results of the winter/spring sampling and analysis regime are included in Table 2. Table 3 contains the results of the empirical modeling for the same sites and the calculated concentrations. Table 4 compares the sampled data and the calculated data for the four sampling sites with the existing water quality data for Indian Bend Wash. Additionally, existing water quality data from the station at the Salt River and Priest Road is included for comparison on Sites 1 and 2. Other water quality data, from stations further downstream, was compared where needed.

Table 1 - Empirical Equations and Variables

	(Units)	
COD	Pounds	$(407.0 \times (TRN^{0.626}) \times DA^{0.710} \times IA^{0.379} \times 1.518)^{0.826} \times 1.881 \times 1.670$
BOD	Pounds	$117.5 \times (DA)^{0.382} \times 3.042$
Suspended Solids	Pounds	$(17780 \times TRN)^{0.837} \times (DA)^{1.311} \times (IA)^{1.180} \times 2.367)^{0.950} \times 0.431 \times 1.967$
Dissolved Solids	Pounds	$(20.7 \times (TRN)^{0.637} \times (DA)^{1.311} \times (IA)^{1.180} \times 1.249)^{0.688} \times 7.326 \times 1.220$
Nitrogen (Total)	Pounds	$(20.2 \times (TRN)^{0.825} \times (DA)^{1.070} \times (IA)^{0.479} \times 1.258)^{0.679} \times 1.197 \times 1.255$
Nitrogen (NH and Organic)	Pounds	$(13.9 \times (TRN)^{0.722} \times (DA)^{0.781} \times (IA)^{0.328} \times 1.722)^{0.947} \times 0.421 \times 1.304$
Phosphorus (Total)	Pounds	$(1.725 \times (TRN)^{0.884} \times (DA)^{0.826} \times (IA)^{0.467} \times 2.130)^{0.931} \times 0.352 \times 1.377$
Phosphorus (Dissolved)	Pounds	$(0.540 \times (TRN)^{0.976} \times (DA)^{0.795} \times (IA)^{0.573} \times 2.464)^{0.435} \times 0.217 \times 1.446$
Cadmium (Total)	Pounds	$(0.039 \times (TRN)^{0.845} \times (DA)^{0.753} \times (LUI)^{0.138} \times (LUC)^{0.248} \times (LUN)^{-0.374} \times 1.244)^{1.144} \times 0.781 \times 1.201$
Copper (Total)	Pounds	$(0.141 \times (TRN)^{0.807} \times (DA)^{0.590} \times (LUI)^{0.424} \times (LUC)^{0.274} \times (LUN)^{-0.061} \times (INT)^{0.928} \times 1.502)^{1.237} \times 0.536 \times 1.562$
Lead (Total)	Pounds	$(0.162 \times (TRN)^{0.839} \times (DA)^{0.808} \times (IA)^{0.744} \times 1.791)^{0.815} \times 0.110 \times 2.244$
Zinc (Total)	Pounds	$(0.320 \times (TRN)^{0.811} \times (DA)^{0.798} \times (IA)^{0.627} \times 1.639)^{0.800} \times 0.442 \times 1.421$
Total Storm Runoff	ft^3	$(1,123,052.0 \times (TRN)^{1.016} \times (DA)^{0.916} \times (IA)^{0.677} \times (MAR)^{-1.312} \times 1.299)^{0.963} \times 0.491 \times 1.154$

Variables are:

TRN - Total Storm Rainfall in inches (event specific)
DA - Drainage Area in square miles (site specific)
IA - Impervious Area in percent (site specific)
LUI - Land Use Industrial in percent (site specific)
LUC - Land Use Commercial in percent (site specific)
LUN - Land Use Undeveloped in percent (site specific)
INT - Storm Intensity (inches) (used 1.44 inches in all equations) (see USGS WPI Report 94-4240, page 41)
MAR - Mean Annual Rainfall (used 7.11 inches in all equations) (see USGS WPI Report 94-4240, page 41)

Base Equation: $(BO \times (TRN)^{B1} \times (DA)^{B2} \ldots \times BCF)^{BN} \times BO_{adjusted} \times BCF_{adjusted}$

It should be noted that Sites 7 and 8 are not included in the Tables. As a result of unfavorable meteorological conditions these areas were sampled after the completion of the draft of this report. The laboratory results are included in this appendix, and the results are included in the discussions of the specific constituents. It should be noted that the Sites called 7 and 8 in this report are noted as 5 an 6 in the laboratory report sheets.

Sampled data was collected as a first-flush sample (within one hour of the commencement of the storm) and a second sample. The first precipitation event was recorded on 25 February 1997 and the second storm event was recorded on 02 April 1997. It should be noted that the 25 February 1997 event was not the first precipitation event of the so-called winter rainy season. Also, as discussed previously, an additional precipitation event within approximately 24 hours of event one was required to gather second sample data from some sites. Site 2 did not exhibit flow during the second precipitation event and, therefore, no samples were collected at Site 2.

The sampling and analysis at Sites 7 and 8 (additional sites added later in the study) was conducted on 06 August 1997. The storm event was a typical convective summer thunderstorm. Both sites exhibited flow and were sampled once during the early stages of the flow event. A brief discussion of the results of the for each constituent are noted below:

Organochloride Pesticides - Sampling and analysis for this constituent was conducted at Site 1 during the first sample of the first precipitation event (a probable worst-case scenario). Sites 7 and 8 were sampled during a summer monsoon event on 06 August 1997. No pesticide residue was detected in the analysis. This constituent is not calculated by the empirical equations nor is it measured at the USGS station on IBW. The station on Priest and Salt River indicates only trace amounts of pesticide residue. Normally, this constituent is not considered likely in urban areas. However, past land uses such as agricultural activity can leave residues that may manifest themselves during runoff events.

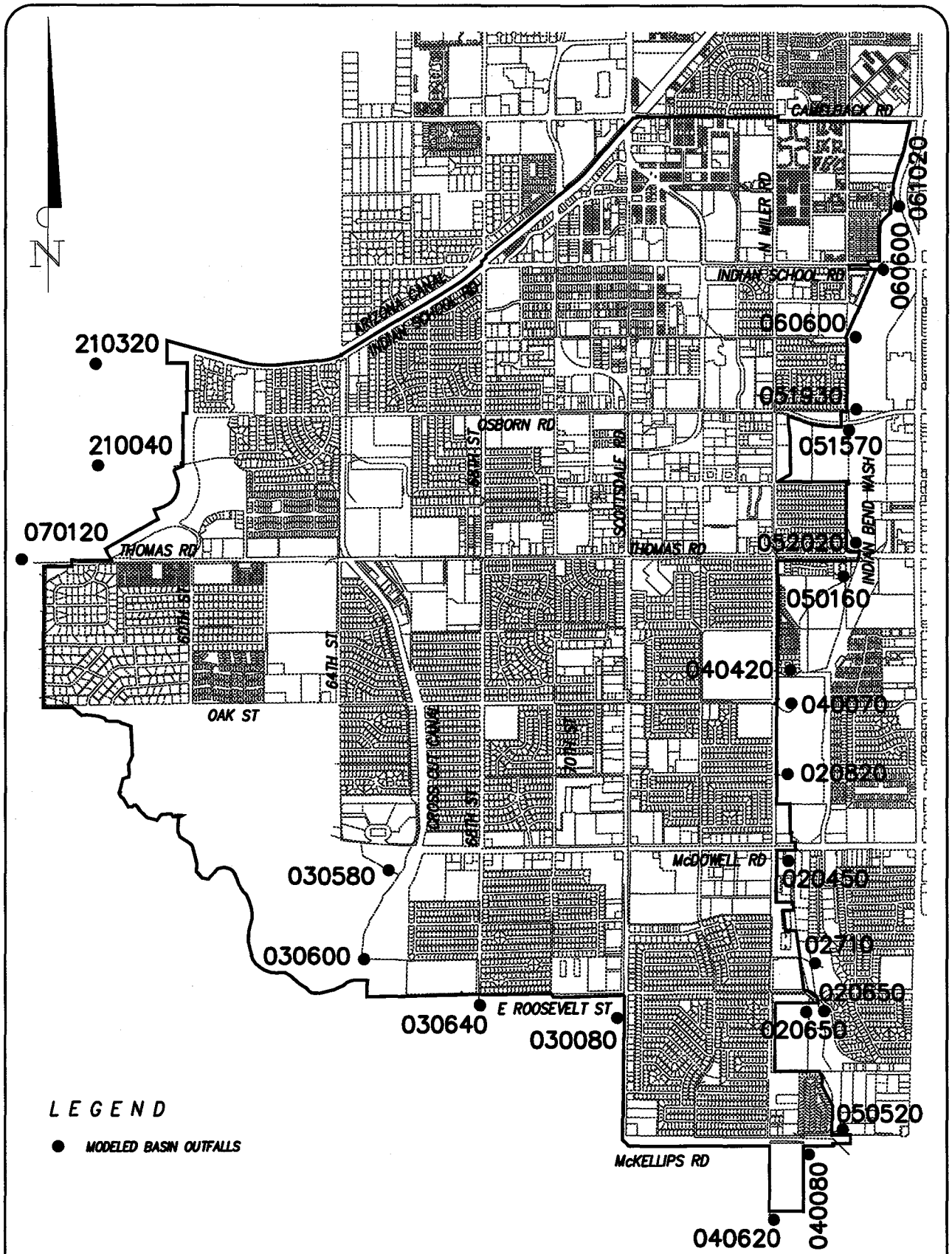
Purgable Organics- Sampling and analysis was conducted at Site 1 during the first flush sample of the first precipitation event. Sites 7 and 8 were sampled on 06 August 1997. No purgable organics were detected in the sample. The USGS station at Indian Bend Wash does not measure purgable organics, and the empirical equations do not calculate a value for that constituent. Limited analysis available at the station at Salt River and Priest Road indicates trace amounts of purgable organics. This analysis was included based on past and present land use in the study area. The lack of detectable levels does not necessarily indicate the area is free from these potential contaminants.

Priority Metals - This analysis was conducted for all 13 priority metals at all four original sites and for both precipitation events. Sites 7 and 8 were sampled once on 06 August 1997. Copper, nickel and zinc were detected at various sites. Copper was detected at all four sites (during various sample events) in values ranging from 0.071 mg/L to below detection levels. Zinc was detected at all sites (in various sample events) with levels of 0.60mg/L and below. Nickel was detected at Site 3 in the first-flush sample of precipitation event 2 at a level of 0.076 mg/L. In all instances for all three detected metals, the first-flush sample was higher than the second sample.

Copper concentration values for Sites 1 and 2 were compared to water quality station 09512165 located at Salt River/Priest Drive. Measured levels of copper concentration at this station were below 0.1 mg/L, which compares with the sampled and calculated results.

Copper concentrations from Sites 3 and 4 were compared to values at the station on IBW/Curry. Peak values for this USGS station were higher than any value calculated or sampled. Average values were comparable.

Zinc values at the USGS stations averaged 0.11 mg/L with a peak of 0.6 mg/L and a minimum value of 0.003 mg/L. Calculated values range from 0.18 to 0.12 mg/L. Sampled data compares favorably with both the calculated and existing data. It should be noted that existing data at the Salt River/Priest Drive station was incomplete.



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EMPIRICAL EQUATION OUTFALL LOCATION

FIGURE 4

SCALE: N.T.S.

Table 2 - Stormwater Quality Analysis for Field Sampled Sites

Constituents		EPA Method	Site 1				Site 2				Site 3				Site 4				Site 5
			Event 1		Event 2		Event 1		Event 2		Event 1		Event 2		Event 1		Event 2		Event 3
Organochlorine Pesticides		608	ND	ND			NT	NT			NT	NT			NT	NT			
Purgable Organics		624	ND	ND			NT	NT			NT	NT			NT	NT			
Priority Metals (detected) (mg/L)	Copper	6010A	0.071	0.021	0.053	0.039	0.017	0.013	No Flow	No Flow	0.030	0.02	0.062	0.022	ND	ND	0.026	ND	
	Zinc	6010A	0.32	0.073	0.25	0.25	0.054	0.035	No Flow	No Flow	0.060	0.13	0.15	0.097	0.012	ND	0.21	ND	
	Nickel	6010A	ND	ND	ND	ND	ND	ND	No Flow	No Flow	ND	ND	0.076	ND	ND	ND	ND	ND	
Semi Volatile Organics		625	ND	ND			NT	NT	NT	NT	NT	NT			NT	NT			
Inorganic Non-Metals (mg/L)	Oil and Grease	413.1	5	4	5.2	7.8	2	2	No Flow	No Flow	ND	11	4.7	2.2	ND	ND	4.8	ND	
	TSS	SM2540D	56.2	99.2	24	22	57.8	4.4	No Flow	No Flow	2.4	58.5	30	14	8.4	3.2	24	5.2	
	Nitrate As N	300.0	2.6	0.4	NT	NT	NT	NT	NT	NT	NT	NT			NT	NT			
	Nitrite As N	300.0	ND	ND	NT	NT	NT	NT	NT	NT	NT	NT			NT	NT			
	Sulfate	300.0	43	3.3	NT	NT	NT	NT	NT	NT	NT	NT			NT	NT			
	T. Cyanide		ND	ND	NT	NT	NT	NT	NT	NT	NT	NT			NT	NT			
	T. Phosphorus		0.5	0.32	NT	NT	NT	NT	NT	NT	NT	NT			NT	NT			
Fecal Coliform		SM18-9221B&C	30	17	1600	170	>1600	80	No Flow	No Flow	30	>1600	>1600	>1600	900	900	>1600	50	
COD			230	30	220	160	60	40	No Flow	No Flow	40	50	240	170	50		230	40	

LEGEND:
TSS - Total Suspended Solids
COD - Chemical Oxygen Demand

ND - Not Detected
NT - Not Tested

Samples:
Event 1 Samples taken 02/25/97
Event 2 Samples taken 04/02/97
Event 3 at sites 5 & 6 - only mid-event sample
To be sampled at first "summer monsoon event"

Table 3 - Empirical Calculations for Sample Sites

INPUT Outlet ID		Site 1 030540				Site 2 030680				Site 3 060130				Site 4 110040			
		Storm 1		Storm 2		Storm 1		Storm 2		Storm 1		Storm 2		Storm 1		Storm 2	
		Rain Gage 1	Rain Gage 2	Rain Gage 1	Rain Gage 2	Rain Gage 1	Rain Gage 2	Rain Gage 1	Rain Gage 2	Rain Gage 1	Rain Gage 2	Rain Gage 1	Rain Gage 2	Rain Gage 1	Rain Gage 2	Rain Gage 1	Rain Gage 2
Total storm rainfall [in]	(TRN)	0.67	0.79	0.28	0.28	0.67	0.79	0.28	0.28	0.67	0.79	0.28	0.28	0.67	0.79	0.28	0.28
Drainage Area [mi2]	(DA)	0.38	0.38	0.38	0.38	0.72	0.72	0.72	0.72	0.37	0.37	0.37	0.72	0.22	0.22	0.22	0.22
Impervious area [%]1	(IA)	28.32	28.32	28.32	28.32	15.3	15.3	15.3	15.3	39.32	39.32	39.32	15.3	49.49	49.49	49.49	49.49
Land Use - Industrial [%]1	(LUI)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Land Use - Commercial [%]1	(LUC)	13.57	13.57	13.57	13.57	6.52	6.52	6.52	6.52	1	1	1	6.52	10.3	10.3	10.3	10.3
Land Use - Undeveloped [%]1	(LUN)	43.06	43.06	43.06	43.06	70.46	70.46	70.46	70.46	3.63	3.63	3.63	70.46	1	1	1	1
Storm Intensity [24hr-2yr]	(INT)	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Mean annual rainfall [in]	(MAR)	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11

STORM RUNOFF CONSTITUENT LOADS																	
Chemical oxygen demand	Pounds	833	907	530	530	969	1,086	636	636	909	969	579	636	720	784	458	458
5-day biological oxygen demand	Pounds	246.99	246.99	246.99	246.99	315.28	315.28	315.28	315.28	244.48	244.48	244.48	315.28	200.45	200.45	200.45	200.45
Suspended solids	Pounds	1,425	1,632	695	695	2,023	2,317	986	986	1,469	1,683	716	986	1,081	1,216	517	517
Dissolved solids	Pounds	443.3	476.5	302.4	302.4	478.5	514.4	326.5	326.5	564.8	607.1	385.4	326.5	426.0	457.9	290.6	290.6
Nitrogen, total	Pounds	15.9	17.4	9.7	9.7	20.7	22.6	12.7	12.7	17.3	18.0	10.6	12.7	12.8	14.0	7.8	7.8
Nitrogen, ammonia plus organic, total	Pounds	11.7	13.1	6.4	6.4	15.5	17.3	8.5	8.5	12.7	14.2	7.0	8.5	9.3	10.4	5.1	5.1
Phosphorus, total	Pounds	2.38	2.73	1.16	1.16	2.98	3.41	1.45	1.45	2.89	3.08	1.31	1.45	1.99	2.28	0.97	0.97
Phosphorus, dissolved	Pounds	0.29	0.31	0.20	0.20	0.31	0.33	0.21	0.21	0.31	0.33	0.21	0.21	0.27	0.29	0.19	0.19
Cadmium, total recoverable	Pounds	0.00	0.00	0.002	0.002	0.00	0.00	0.002	0.002	0.00	0.01	0.002	0.002	0.01	0.01	0.005	0.005
copper, total recoverable	Pounds	0.11	0.13	0.05	0.05	0.13	0.16	0.06	0.06	0.05	0.06	0.02	0.06	0.09	0.11	0.04	0.04
Lead, total recoverable	Pounds	0.27	0.31	0.16	0.15	0.29	0.32	0.16	0.16	0.33	0.37	0.16	0.16	0.27	0.30	0.15	0.15
Zinc, total recoverable	Pounds	0.83	0.93	0.47	0.47	0.92	1.02	0.52	0.52	0.97	1.08	0.55	0.52	0.78	0.87	0.44	0.44
Storm runoff	ft³	104,416	122,683	44,467	44,467	122,621	144,304	52,304	52,304	126,321	148,417	53,795	52,304	92,778	109,007	39,510	39,510

CALCULATED CONCENTRATIONS																	
Chemical oxygen demand	mg / L	127.84	118.46	191.20	191.20	130.39	120.85	195.01	195.01	115.29	106.86	172.43	195.01	124.37	115.26	186.00	186.00
5-day biological oxygen demand	mg / L	37.91	32.27	89.03	89.03	41.14	35.02	96.62	96.62	31.02	26.40	72.84	96.62	34.63	29.47	81.32	81.32
Suspended solids	mg / L	218.79	213.28	250.42	250.42	263.99	257.35	302.16	302.16	186.45	181.76	213.41	302.16	183.38	178.76	209.89	209.89
Dissolved solids	mg / L	68.04	62.25	109.01	109.01	62.45	57.13	100.05	100.05	71.67	65.57	114.82	100.05	73.59	67.33	117.90	117.90
Nitrogen, total	mg / L	2.43	2.27	3.51	3.51	2.70	2.52	3.88	3.88	2.20	2.05	3.16	3.88	2.21	2.06	3.18	3.18
Nitrogen, ammonia plus organic, total	mg / L	1.79	1.71	2.32	2.32	2.02	1.92	2.61	2.61	1.61	1.53	2.08	2.61	1.60	1.52	2.07	2.07
Phosphorus, total	mg / L	0.37	0.36	0.42	0.42	0.39	0.38	0.45	0.45	0.34	0.33	0.39	0.45	0.34	0.34	0.39	0.39
Phosphorus, dissolved	mg / L	0.04	0.04	0.07	0.07	0.04	0.04	0.07	0.07	0.04	0.04	0.06	0.07	0.05	0.04	0.08	0.08
Cadmium, total recoverable	mg / L	0.00	0.00	0.001	0.001	0.00	0.00	0.001	0.001	0.00	0.00	0.001	0.001	0.00	0.00	0.002	0.002
copper, total recoverable	mg / L	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02
Lead, total recoverable	mg / L	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.04	0.06	0.06
Zinc, total recoverable	mg / L	0.13	0.12	0.17	0.17	0.12	0.11	0.16	0.16	0.12	0.12	0.16	0.16	0.13	0.13	0.18	0.18

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Table 4 - Comparison of Sampled, Empirical and Existing Data

Constituent	*Sampled Data* (1st Event-1st Sample/1st Event-2nd Sample) (2nd Event-1st Sample/2nd Event-2nd Sample) Site 1	Site 2	Site 3	Site 4	*Calculated Data* (Event 1) (Event 2) Site 1	Site 2	Site 3	Site 4	*Existing Data* (Station 09512162 IBW/Curry) Station 09512165 Salt R/Priest Peak	AVG	Minimum
Organochloride	ND/ND	NT	NT	NT	NC	NC	NC	NC	All Reporting Station		
Pesticides	NT	NT	NT	NT					Trace Amounts		
	ND/ND	NT	NT	NT	NC	NC	NC	NC	All Reporting Station		
Purgable Organics	NT	NT	NT	NT					Trace Amounts		
Priority Metals											
	0.071/0.021	0.017/0.013	0.030/0.02	ND/ND	0.02	0.02	0.01	0.02	0.13	0.026	0.005
Copper (mg/L)	0.053/0.039	No Flow	0.062/0.022	0.026/ND	0.02	0.02	0.02	0.02	0.058	0.019	0.002
	0.32/0.073	0.054/0.035	0.060/0.13	0.012/ND	0.13	0.12	0.12	0.13	0.6	0.11	0.01
Zinc (mg/L)	0.25/0.25	No Flow	0.15/0.097	0.21/ND	0.17	0.16	0.16	0.18	0.003	0.003	0.008*
	ND/ND	ND	ND/ND	ND	NC	NC	NC	NC	0.057	0.011	0.001
Nickel (mg/L)	ND/ND	No Flow	0.076/ND	ND					<0.01	<0.01	<0.01*
Semi Volatile Organics	ND	NT	NT	NT	NC	NC	NC	NC			
	5.0/4.0	2.0/2.0	ND/11	ND/ND	NC	NC	NC	NC	< 1	< 1	< 1
Oil and Grease (mg/L)	5.2/7.8	No Flow	4.7/2.2	4.8/ND					< 1	< 1	< 1
	56.2/99.2	57.8/4.4	2.4/58.5	8.4/3.2	218.79	263.99	186.45	188.38	920.0	215.5	9.0
TSS (mg/L)	24.0/22.0	No Flow	30.0/14.0	2.4/5.2	250.42	302.16	302.16	209.89	440	298.2	180
	2.6/0.4	NT	NT	NT					3.46	1.15	0.33
Nitrate As N (mg/L)	NT	NT	NT	NT					0.220	0.164	0.110
	ND/ND	NT	NT	NT					0.140	0.05	0.010
Nitrate As N	NT	NT	NT	NT	NC	NC	NC	NC	0.080	0.04	<0.010*
	43.0/3.3	NT	NT	NT	NC	NC	NC	NC	70	28.9	11
Sulfate (mg/L)	NT	NT	NT	NT					72	48.8	20
	ND	NT	NT	NT	NC	NC	NC	NC	< 0.010	< 0.010	< 0.010
T. Cyanide (mg/L)	NT	NT	NT	NT					<0.010	<0.010	<0.010
	0.5/0.32	NT	NT	NT	0.37	0.39	0.34	0.34	0.52	0.23	0.11
T. Phosphorus (mg/L)	NT	NT	NT	NT	0.42	0.45	0.45	0.39	1.90	0.59	<0.20
	30.0/17.0	>1600.0/8.0	30.0/>1600.0	900.0/900.0	NC	NC	NC	NC	...	...	...
Fecal Coliform	1600.0/170.0	No Flow	>1600.0/>1600.0	>1600.0/50.0					290	195	100*
	230.0/30.0	60.0/40.0	40.0/50.0	50.0/...	127.89	130.39	115.29	129.37	330.0	77.8	15.0
COD	220.0/160.0	No Flow	240.0/170.0	230.0/40.0	191.2	195.01	195.01	186.0	61.0	36.8	13.0

* Limited Data

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Constituent loads for nickel are not calculated by the empirical equations. The water quality stations data indicate nickel levels varying from a peak of 0.057 mg/L to 0.001 mg/L, with an average of 0.011 mg/L. Nickel was detected at one site at a level (0.076 mg/L - at Site 3 during the first flush of the second event) higher than the peak at the USGS station. No other samples detected nickel.

Semi-volatile organics - No semi-volatile organics were detected in the sampling regime. The empirical equations do not calculate values for semi-volatile organics, and the USGS station does not measure the constituent. Again, this analysis was included in response to past and present land use in the study area. This limited sampling should not be considered sufficient to conclude that the area does not contain levels of these contaminants.

Oils and Greases - Sampled data during the winter/spring period ranged from a peak of 7.8 mg/L to a minimum of 2.0 mg/L. Sites 7 an 8 (August samples) were near the midpoint of that range. The majority of the sites exhibited higher levels of oils and grease on the first-flush sample. However, Site 1 and Site 3 exhibited higher second sample readings. Site 1 had a higher second sample during the second precipitation event, and Site 3 had a higher second sample during the first precipitation event. One potential reason for this apparent abnormality might be low flows during the first-flush sample that had yet to flush the oil and grease from the sub-basin. It also might indicate that the oil and greases are entering the discharge stream in the upper end of the basin or other reasons (such as detention areas) are contributing to increasing the lag time of the runoff.

The empirical equations do not calculate oil and grease levels. The water quality stations had consistent readings less than 1 mg/L, with the exception of one reading of 9.0 mg/L at the 24th Street/Salt River gauging station. All of the sample sites (with the exception of Site 4 which had non-detectable levels of oil and grease except for one first-flush sample) have first-flush and second sample levels that are higher than those recorded for the gauging stations.

Total Suspended Solids (TSS) - Sample data for total suspended solids ranged from a peak of 99.2 mg/l to a minimum of 2.4 mg/L. Sites 1 and 2 (discharging to Salt River) had higher values than Sites 3 and 4 which discharge to IBW. In two instances during the first precipitation event at Sites 1 and 3, the second sample revealed a significant increase in TSS when compared to the first-flush sample (one other sample at the second event at Site 4 was slightly higher, but the increase was not significant). Sites 7 and 8 were only sampled once during the 06 August storm. The remainder of the sampled sites revealed a first-flush sample with higher TSS values than the second sample. Again, the cause of the increased levels in the second sample is unclear but may be the result of low velocity flows during the onset of the runoff event.

The empirical equations calculate TSS values that are significantly greater; the peak value is calculated at 302.16 mg/L and the minimum level is 186.45 mg/L. Existing data at the IBW/Curry Station indicate that TSS levels (recorded as Residue Total at 105 degrees. C, suspended) vary from a recorded peak of 920 mg/L to a minimum of 9 mg/L with an average value of 215.5 mg/L. It should be noted that the TSS value of 9 mg/L, recorded at the USGS station, is relatively inconsistent with the other values. The remaining USGS station values noted are 30 mg/L or higher. The sampled values for Sites 3 and 4 are lower than the calculated value and the average USGS station data for the receiving water. If the unusually low value of 9 mg/L is removed, the TSS data from the sampling sites compares favorably with the low value for existing IBW data.

Sites 1 and 2 also compare favorably to existing data from the Salt River/Priest water quality station. Peak sampling values for Sites 1 and 2 are in the mid to upper 50 mg/L range, calculated by values ranging from 218.79 to 203.99 mg/L, and the gauging station records average values of 298.2 mg/L (peak 440.0 Mg/L, minimum 1,800 mg/L).

Nitrate as N - Nitrate as N was measured at Site 1 for the first precipitation event. The values recorded are 2.6 mg/L first-flush and 0.4 mg/L second sample. Nitrate as N measured at the Salt River/Priest station has a peak discharge of 0.220 mg/L and a minimum discharge of 0.110 mg/L. The average of the values for the station is 0.164 mg/L. Sample results indicate nitrate concentrations are greater than recorded values. However, sample data is limited to one event and may not be representative of levels in the study area.

Nitrite as N - No Nitrite as N was detected in the sampling of Site 1 (the only site sampled). Values recorded at the Salt River/Priest station vary from 0.050 mg/L to 0.010 mg/L. The empirical equations calculate values for total nitrogen and nitrogen-ammonia plus organic. These values range from a high of 3.51 mg/L of total nitrogen to a minimum of 2.20 mg/L; while nitrogen (ammonia and organic) ranges from a high of 2.61 mg/L to a minimum of 1.53 mg/L.

Sulfate - Sulfate was measured at Site 1 for the first precipitation event and at Sites 7 and 8 for the summer storm. Sulfate concentrations were noted as 43 mg/L for the first sample and 3.3 mg/L for the second sample. Sulfate concentrations at Site 7 were recorded as 24 mg/L and 0.28 mg/L at Site 8. The empirical equations do not calculate a value for sulfate. Sulfate values at the Salt River/Priest station vary from 72.0 mg/L as a peak to 20 mg/L at a minimum. The average value at the Salt River/Priest station is 48.8 mg/L.

Total Cyanide - Cyanide was not detected in the samples taken during precipitation event one at Site 1 nor at Sites 7 and 8. Both water quality stations report cyanide levels below 0.010 mg/L. The empirical equations do not estimate cyanide levels.

Total Phosphorus - Total phosphorus was measured at Site 1 during precipitation event one and at Sites 7 and 8 during the summer storm. The first-flush sample levels were 0.5 mg/L, and the second sample's concentration level was 0.32 mg/L of phosphorus. Site 7 had a phosphorus value of 0.57 mg/L and Site 8 had a value of 0.28 mg/L. Calculated values for phosphorus ranged from 0.45 mg/L for a peak to 0.34 mg/L for a minimum value. Values recorded at the Salt River/Priest station range from a peak of 1.90 mg/L to <0.20 mg/L; with an average value of 0.59 mg/L.

Fecal Coliform (MPN) - Fecal coliform was measured at all four original sampling sites and at the two additional sites. Values range from greater than 1600 colonies/100ml to 30 colonies/100ml. The empirical equations do not calculate fecal coliform. Fecal coliform data is available from the Salt River/Priest station where values range from 290 to 100 colonies/100ml. It should be noted that the samples were analyzed based on a procedure that results in a maximum probable number (MPN) and not necessarily an actual population count.

Chemical Oxygen demand (COD) - Sampled data indicates COD values from 244 mg/L during the first flush of an event to 30 mg/L for the later sample. Calculated values for this constituent vary from 115 mg/L to 195 mg/L. Sample site 7 had the highest value for COD. The mean COD value for all sampled events is 120 mg/L. Existing water quality data at the existing stations ranged from a peak of 330 mg/L to a minimum of 13 mg/L.

Site 3 has the highest COD value during the first-flush event of the second precipitation event. The recorded 240 mg/L is lower than the value recorded at peak in IBW. Sites 1 and 2 have higher COD values than the values recorded for the Salt River/Priest water quality station.

Summary and Recommendations

While the results of the analysis appear to indicate that no acute stormwater quality issues within the study area are evident, further analysis may be required. The limited sampling regime and the statistical uncertainty of the empirical data require that these conclusions and recommendations be considered preliminary. Additional sampling or monitoring requirements will most likely be required for NPDES permitting.

While no acute issues were noted, several chronic problems may require action to prevent cumulative impacts to area water quality. All sampled sites exhibit oil and grease levels that are greater than the levels in the areas measured by USGS stations. Further consideration should be given to implementing methodologies to contain oil and grease in this area. These control measures could be point-source specific physical containment measures or management controls. Areas immediately adjacent to Sites 1 and 2 appear to be more sensitive to oil and grease then other discharge points. It may be prudent to prioritize oil and grease control measured in these areas. It would appear that while the oil and grease discharge is a potentially detrimental factor in the immediate area's discharge, it does not have an immediately recognizable effect on receiving water discharge quality. The long-term cumulative effects of this discharge on the immediate vicinity and the overall discharge stream are unclear.

Additionally, several sites note TSS levels in first-flush samples (assuming as discussed earlier that the higher numbers noted in the 2nd flush are related to flow volumes) that are noteworthy. This is most likely a function of the arid environment and particulate build-up. Given the potential for particle born pollutants, structural treatments (i.e., storage facilities, stilling basins, sediment traps) should be considered to reduce suspended solids in the discharge stream.

Sampling / Analysis of Regime Alternatives

FLOOD CONTROL DISTRICT
RECEIVED
JAN 23 1997
REMARKS

Suite 250
7600 N. 15th Street
Phoenix, Arizona
85020

Mr. H. Scott Clement
Maricopa County Flood Control District
2801 West Durango Street
Phoenix, AZ 85009

Subj: STP Papago ADMP, 091131.00
Water Quality Analysis Task

Dear Mr. Clement:

Based on the existing water quality data, field reconnaissance information and public identified problem areas several sampling scenarios have been developed. Three possible sampling schemes have been developed that will measure identified areas of concern and provide additional information as to water quality in the study area.

There are numerous variables involved in any sampling program. The sampling schedules provided below attempt to provide a balance between scientific sampling protocol, the need for information, the need for a contingency in the event problem areas develop and the requirement not to exceed the budget established for sampling. Certain parameters are common to the three regime and are listed below. The proposed sampling regimes and proposed sampling sites are also described below:

Parameters common to all three regimes:

- All three regimes provide information for the areas that were identified in the field reconnaissance and during public/agency scoping meetings (Sites 1 and 2).

- Sample method will be by grab sample with the first sample obtained within two hours (first flush event) of discharge and the subsequent sample at least one hour later. If the precipitation event does not continue long enough for the second sample a non-first flush sample will be obtained from the next precipitation event.

TEL 602 944 5500
FAX 602 944 7423

- All samples will be obtained from precipitation induced runoff, no artificial flushing will be employed to obtain samples.

- All sampling will adhere to the standard storm water sampling protocol as outlined in the EPA's NPDES Storm Water Sampling Guidance Document.

- None of the three sampling regimes proposed provide sampling as complete as is normally required for NPDES permit application.

Potential Sample Sites

The following sites were identified as potential sampling points. These sites represent discharges from several of the different sub-basins identified within the study area. Based on the final selected sampling regimes, a subset of these potential sites will be used. Sites 1 and 2 were identified based on public and agency concerns involving the potential of specific discharges from that area. Where possible the samples will be taken from existing culverts at the sites.

Site 1 at inlet end of a 48 inch CMP at McDowell Road immediately west of Cross-cut Canal.

Site 2 the discharge end of a 30 inch RCP crossing the Cross Cut Canal on the PERA Club site.

Site 3 at a pipe at the east end of 2nd Street where it outfalls into the golf course in Indian Bend Wash (IBW).

Site 4 at a box culvert at 48th Street and Earl Road (outside of the study area - discharges to Old Cross Cut Canal)

Site 5 at a pipe at the east end of Oak Street where it outfalls into El Dorado Park in IBW.

Site 6 at a pipe immediately south of McKellips Road where it outfalls into Rio Salado Golf Course in IBW.

The following three sample regimes are designed to be completed for the $15000.00 budgeted in the STP-Papago study:

Recommended Sampling Regime

This regime would sample the first four sites listed above (Sites 1, 2, 3 and 4). It proposes to sample two precipitation events, and provide two samples from each site, a first flush (within 2 hours of the start of the runoff) and another sample later in the flow event). It would not complete the full "standard NPDES" analysis (see Regime 2 for a listing of the analysis included in the "standard NPDES" group) for all of the sites. Site

I would have the full "standard NPDES" analysis completed for the first storm and a reduced analysis group for the second storm. The remainder of the sample sites would have a reduce analysis group that would include oil and grease, total suspended solids, priority metals and possibly fecal bacteria and chemical oxygen demand (depending on budget constraints). These are the constituents normally found in areas with a high percentage of impervious surfaces. This regime provides for a limited geographic sample area (more limited than Alternative Regime A but less limited than Alterative Regime B) It also provides for sampling of two precipitation events at four sites, thus reducing the chance of an anomalous result for a single precipitation event skewing the results.

Alternative Regime A

This regime involves sampling each of the listed six sites for the following constituents; volatile organics, semi-volatile organics, cyanide, total phenols, priority pollutant metals, oil and grease, anions, and total suspended solids, the "standard NPDES analysis group. This regime collects samples at each site at one precipitation event. Two samples (a first flush and a later sample) will be obtained for the single precipitation event sampled.

This regime provides the most raw data and the largest group of analysis of any of the regimes. It may be useful for background information for the study required for NPDES permit activity but does not allow for a competitive review between two events. Three of the proposed sites discharge to Indian Bend Wash, an area that has existing water quality information available from a USGS station to the south.

Alternative Regime B

Alternative Regime B would provide analysis for the full NPDES sampling group as noted in Alternative Regime A. It would sample sites 1, 2 and 3 or 4. A decision as to which of sites 3 or 4 is the most advantageous is required prior to sampling. Sampling would be conducted for two precipitation events, and the sampling of first flush and a later sample for each event would be as the other regimes.

Regime B does not provide as large a geographic sampling as Regime A or the Preferred Regime. It is possible that land use data may indicate potential water quality issues in areas not sampled. It also does not provide a contingency budget in case additional sampling is indicated. It does allow for the comparison of two precipitation events and thus increases the chance of an anomalous analysis skewing the results.

Kimley- Horn and Associates believes the recommended regime would provide the best level of information while staying within the parameters discussed above.

Once you authorize this work, by signing below, our sampling staff and laboratory can be alerted for the next significant precipitation event. Please contact our office with any questions or requests for clarification.

Sincerely,

KIMLEY-HORN AND ASSOCIATES, INC.

Doug Plasencia, P.E.
Project Manager

DJP/pac

Accepted:

2/4/97

Flood Control District of Maricopa County

Kimley-Horn & Associates, Inc.

Results of Basin Outfall Empirical Calculations

Storm Runoff Constituent Loads, Volumes, and Mean Concentrations for Selected Basins in STP Papago Project Area

Storm: February 27, 1997

INPUT		4600: IBW @ McKellips Rd.																	
Outfall ID		010080	010520	010820	020090	020450	020650	020740	020820	030080	030580	030600	030640	040070	040420	050160	051570	051930	052020
Total storm rainfall [in]	(TRN)	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Drainage Area [mi2]	(DA)	0.27	0.02	0.02	0.42	0.14	0.1	0.11	0.07	0.29	0.38	0.72	0.82	0.55	0.08	1.5	0.12	0.07	0.05
Impervious area [%]1	(IA)	46.58	55	55	91.06	89.08	47.51	69.3	86	55.01	28.32	15.3	19.89	87.54	84.89	68.04	38.39	36	36
Land Use - Industrial [%]1	(LUI)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Land Use - Commerical [%]1	(LUC)	2.48	1	1	1	1	1	1	1	1	13.57	6.52	6.75	2.27	1	16.66	2.72	1	1
Land Use - Undeveloped [%]1	(LUN)	3.11	1	1	39.5	1	1	1	24.54	1	43.06	70.46	72.78	71.13	30.57	10.86	1	1	1
Storm Intensity [24hr-2yr]	(INT)	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Mean annual rainfall [in]	(MAR)	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11

STORM RUNOFF CONSTITUENT LOADS																			
Chemical oxygen demand	Pounds	796	182	182	1,273	664	448	533	437	875	833	999	1,171	1,473	471	2,452	466	333	273
5-day biological oxygen demand	Pounds	216.76	80.20	80.20	256.61	168.66	148.32	153.82	129.43	222.76	246.99	315.28	331.34	284.46	136.20	417.31	159.02	129.43	113.82
Suspended solids	Pounds	1,212	205	205	1,818	848	612	691	522	1,305	1,425	2,023	2,302	2,178	572	4,198	672	459	363
Dissolved solids	Pounds	487.8	53.4	53.4	1,252.2	456.6	202.4	299.6	237.5	595.5	443.3	478.5	665.8	1,546.7	265.1	3,115.8	200.6	117.1	86.5
Nitrogen, total	Pounds	14.5	2.3	2.3	24.9	11.1	7.1	8.6	6.7	16.2	15.9	20.7	24.7	29.9	7.3	57.2	7.6	5.0	3.9
Nitrogen, ammonia plus organic, total	Pounds	10.6	1.6	1.6	18.1	8.0	5.1	6.2	4.7	11.7	11.7	15.5	18.5	21.8	5.2	42.3	5.5	3.6	2.8
Phosphorus, total	Pounds	2.27	0.33	0.33	4.27	1.82	1.07	1.35	1.05	2.58	2.38	2.98	3.69	5.17	1.16	10.02	1.12	0.72	0.56
Phosphorus, dissolved	Pounds	0.29	0.12	0.12	0.40	0.27	0.21	0.24	0.21	0.31	0.29	0.31	0.35	0.43	0.22	0.58	0.21	0.17	0.15
Cadmium, total recoverable	Pounds	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
copper, total recoverable	Pounds	0.06	0.01	0.01	0.05	0.03	0.02	0.02	0.01	0.05	0.11	0.13	0.15	0.08	0.02	0.36	0.04	0.02	0.01
Lead, total recoverable	Pounds	0.30	0.06	0.06	0.60	0.29	0.16	0.21	0.18	0.34	0.27	0.29	0.37	0.70	0.19	1.16	0.15	0.10	0.08
Zinc, total recoverable	Pounds	0.86	0.18	0.18	1.60	0.78	0.46	0.59	0.49	0.98	0.83	0.92	1.14	1.86	0.53	3.11	0.47	0.32	0.26
Storm runoff	ft^3	106,843	11,987	11,987	244,236	91,351	45,064	62,695	48,440	126,829	104,418	122,821	163,448	301,963	54,036	620,815	46,061	27,456	20,405

[1]Add 1 to the value for impervious area, industrial land use, and commercial land use for use in the equation; add 2 to the value for undeveloped areas.

RESULTING CONCENTRATIONS																			
Chemical oxygen demand	mg / L	119.49	243.81	243.81	83.55	116.47	159.20	136.19	144.68	110.58	127.84	130.39	114.80	78.18	139.69	63.30	162.15	194.35	214.67
5-day biological oxygen demand	mg / L	32.52	107.24	107.24	16.84	29.59	52.75	39.32	42.83	28.15	37.91	41.14	32.49	15.10	40.40	10.77	55.34	75.56	89.40
Suspended solids	mg / L	181.82	274.59	274.59	119.32	148.73	217.52	176.68	172.75	164.97	218.79	263.99	225.71	115.61	169.52	108.40	233.86	267.66	285.38
Dissolved solids	mg / L	73.18	71.36	71.36	82.18	80.12	71.98	76.60	78.58	75.26	68.04	62.45	65.29	82.10	78.63	80.44	69.82	68.37	67.91
Nitrogen, total	mg / L	2.18	3.10	3.10	1.64	1.96	2.53	2.20	2.20	2.04	2.43	2.70	2.42	1.59	2.17	1.48	2.64	2.93	3.09
Nitrogen, ammonia plus organic, total	mg / L	1.59	2.17	2.17	1.18	1.40	1.82	1.57	1.56	1.48	1.79	2.02	1.81	1.16	1.54	1.09	1.90	2.10	2.20
Phosphorus, total	mg / L	0.34	0.44	0.44	0.28	0.32	0.38	0.35	0.35	0.33	0.37	0.39	0.36	0.27	0.34	0.26	0.39	0.42	0.44
Phosphorus, dissolved	mg / L	0.04	0.16	0.16	0.03	0.05	0.07	0.06	0.07	0.04	0.04	0.04	0.03	0.02	0.07	0.01	0.07	0.10	0.12
Cadmium, total recoverable	mg / L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
copper, total recoverable	mg / L	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01
Lead, total recoverable	mg / L	0.04	0.08	0.08	0.04	0.05	0.06	0.05	0.06	0.04	0.04	0.04	0.04	0.04	0.06	0.03	0.05	0.06	0.07
Zinc, total recoverable	mg / L	0.13	0.24	0.24	0.10	0.14	0.16	0.15	0.16	0.12	0.13	0.12	0.11	0.10	0.16	0.08	0.16	0.19	0.20

Storm Runoff Constituent Loads, Volumes, and Mean Concentrations for Selected Basins in STP Papago Project Area

Storm: February 27, 1997

INPUT																			
Outfall ID		*060130*	*060600*	*061020*	*061150*	*070120*	*210040*	*210320*	*010080*	*010520*	*010820*	*020090*	*020450*	*020650*	*020740*	*020820*	*030080*	*030580*	*030600*
Total storm rainfall [in]	(TRN)	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Drainage Area [mi2]	(DA)	0.37	0.4	0.05	0.05	0.33	0.22	0.05	0.27	0.02	0.02	0.42	0.14	0.1	0.11	0.07	0.29	0.38	0.72
Impervious area [%]1	(IA)	39.32	56.41	85.77	84.98	35.99	49.49	46.57	46.58	55	55	91.06	89.08	47.51	69.3	86	55.01	28.32	15.3
Land Use - Industrial [%]1	(LUI)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Land Use - Commerical [%]1	(LUC)	1	13.81	1	36.85	3.15	10.3	1	2.48	1	1	1	1	1	1	1	1	13.57	6.52
Land Use - Undeveloped [%]1	(LUN)	3.63	2.25	1	1	21.08	1	1	3.11	1	1	39.5	1	1	1	24.54	1	43.06	70.46
Storm Intensity [24hr-2yr]	(INT)	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Mean annual rainfall [in]	(MAR)	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11

STORM RUNOFF CONSTITUENT LOADS																			
Chemical oxygen demand	Pounds	909	1,065	359	358	826	720	296	867	199	199	1,386	723	487	580	476	953	907	1,088
5-day biological oxygen demand	Pounds	244.48	251.87	113.82	113.82	234.03	200.45	113.82	216.76	80.20	80.20	256.61	168.66	148.32	153.82	129.43	222.76	246.99	315.28
Suspended solids	Pounds	1,469	1,637	414	413	1,340	1,061	378	1,388	235	235	2,082	971	700	792	598	1,495	1,632	2,317
Dissolved solids	Pounds	564.8	812.3	174.9	173.6	474.1	426.0	106.6	524.3	57.4	57.4	1,345.9	490.8	217.5	322.1	255.3	640.1	476.5	514.4
Nitrogen, total	Pounds	17.3	20.6	5.2	5.2	15.5	12.8	4.3	16.0	2.5	2.5	27.3	12.2	7.8	9.5	7.3	17.7	17.4	22.6
Nitrogen, ammonia plus organic, total	Pounds	12.7	15.0	3.7	3.7	11.3	9.3	3.0	11.8	1.8	1.8	20.2	8.9	5.7	6.9	5.3	13.1	13.1	17.3
Phosphorus, total	Pounds	2.69	3.34	0.81	0.81	2.37	1.99	0.62	2.60	0.38	0.38	4.89	2.08	1.22	1.55	1.20	2.96	2.73	3.41
Phosphorus, dissolved	Pounds	0.31	0.35	0.19	0.19	0.29	0.27	0.16	0.31	0.13	0.13	0.43	0.29	0.22	0.25	0.23	0.33	0.31	0.33
Cadmium, total recoverable	Pounds	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
copper, total recoverable	Pounds	0.05	0.15	0.01	0.05	0.07	0.09	0.01	0.07	0.01	0.01	0.06	0.04	0.03	0.03	0.02	0.06	0.13	0.16
Lead, total recoverable	Pounds	0.33	0.43	0.14	0.14	0.29	0.27	0.10	0.33	0.07	0.07	0.67	0.32	0.17	0.23	0.20	0.39	0.31	0.32
Zinc, total recoverable	Pounds	0.97	1.22	0.40	0.40	0.86	0.78	0.29	0.96	0.20	0.20	1.78	0.87	0.51	0.66	0.55	1.09	0.93	1.02
Storm runoff	ft^3	126,321	171,211	35,938	35,721	107,793	92,778	24,134	125,531	14,084	14,084	286,957	107,330	52,947	73,661	56,914	149,013	122,683	144,304

[1]Add 1 to the value for impervious area, industrial land

RESULTING CONCENTRATIONS																			
Chemical oxygen demand	mg / L	115.29	99.70	159.96	160.46	122.89	124.37	196.74	110.74	225.96	225.96	77.43	107.95	147.55	126.22	134.09	102.48	118.49	120.85
5-day biological oxygen demand	mg / L	31.02	23.58	50.76	51.07	34.80	34.63	75.59	27.68	91.28	91.28	14.33	25.19	44.90	33.47	36.45	23.96	32.27	35.02
Suspended solids	mg / L	186.45	153.22	184.44	185.30	199.23	183.38	250.73	177.24	267.68	267.68	116.31	144.99	212.04	172.23	168.41	160.82	213.28	257.35
Dissolved solids	mg / L	71.67	76.05	78.03	77.91	70.50	73.59	70.77	66.95	65.29	65.29	75.18	73.30	65.85	70.08	71.89	68.85	62.25	57.13
Nitrogen, total	mg / L	2.20	1.93	2.32	2.33	2.30	2.21	2.84	2.04	2.89	2.89	1.53	1.83	2.36	2.06	2.06	1.91	2.27	2.52
Nitrogen, ammonia plus organic, total	mg / L	1.61	1.40	1.64	1.64	1.68	1.60	2.02	1.51	2.07	2.07	1.13	1.33	1.73	1.50	1.49	1.41	1.71	1.92
Phosphorus, total	mg / L	0.34	0.31	0.36	0.36	0.35	0.34	0.41	0.33	0.43	0.43	0.27	0.31	0.37	0.34	0.34	0.32	0.36	0.38
Phosphorus, dissolved	mg / L	0.04	0.03	0.08	0.08	0.04	0.05	0.11	0.04	0.15	0.15	0.02	0.04	0.07	0.05	0.06	0.04	0.04	0.04
Cadmium, total recoverable	mg / L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
copper, total recoverable	mg / L	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.02
Lead, total recoverable	mg / L	0.04	0.04	0.06	0.06	0.04	0.05	0.06	0.04	0.08	0.08	0.04	0.05	0.05	0.05	0.06	0.04	0.04	0.04
Zinc, total recoverable	mg / L	0.12	0.11	0.18	0.18	0.13	0.13	0.19	0.12	0.22	0.22	0.10	0.13	0.16	0.14	0.15	0.12	0.12	0.11

Storm Runoff Constituent Loads, Volumes, and Mean Concentrations for Selected Basins in STP Papago Project Area

INPUT		*4640: IBW @ Sweetwater*													
Outfall ID		*030640*	*040070*	*040420*	*050160*	*051570*	*051930*	*052020*	*060130*	*060600*	*061020*	*061150*	*070120*	*210040*	*210320*
Total storm rainfall [in]	(TRN)	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Drainage Area [mi2]	(DA)	0.82	0.55	0.08	1.5	0.12	0.07	0.05	0.37	0.4	0.05	0.05	0.33	0.22	0.05
Impervious area [%]1	(IA)	19.89	87.54	84.89	68.04	38.39	36	36	39.32	56.41	85.77	84.98	35.99	49.49	46.57
Land Use - Industrial [%]1	(LUI)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Land Use - Commerical [%]1	(LUC)	6.75	2.27	1	16.66	2.72	1	1	1	13.81	1	36.85	3.15	10.3	1
Land Use - Undeveloped [%]1	(LUN)	72.78	71.13	30.57	10.86	1	1	1	3.63	2.25	1	1	21.08	1	1
Storm Intensity [24hr-2yr]	(INT)	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Mean annual rainfall [in]	(MAR)	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11

STORM RUNOFF CONSTITUENT LOADS															
Chemical oxygen demand	Pounds	1,275	1,604	513	2,670	507	363	298	989	1,160	391	389	900	784	323
5-day biological oxygen demand	Pounds	331.34	284.46	136.20	417.31	159.02	129.43	113.82	244.48	251.87	113.82	113.82	234.03	200.45	113.82
Suspended solids	Pounds	2,636	2,495	655	4,809	770	525	416	1,683	1,874	474	473	1,535	1,216	432
Dissolved solids	Pounds	715.7	1,662.5	284.9	3,349.1	215.7	125.9	92.9	607.1	873.1	188.0	186.6	509.6	457.9	114.5
Nitrogen, total	Pounds	27.1	32.8	8.0	62.7	8.3	5.5	4.3	19.0	22.6	5.7	5.7	17.0	14.0	4.7
Nitrogen, ammonia plus organic, total	Pounds	20.7	24.4	5.8	47.3	6.1	4.0	3.1	14.2	16.8	4.1	4.1	12.7	10.4	3.4
Phosphorus, total	Pounds	4.22	5.92	1.33	11.47	1.28	0.82	0.64	3.08	3.83	0.93	0.92	2.71	2.28	0.71
Phosphorus, dissolved	Pounds	0.37	0.47	0.24	0.62	0.22	0.18	0.16	0.33	0.37	0.20	0.20	0.31	0.29	0.17
Cadmium, total recoverable	Pounds	0.01	0.00	0.00	0.03	0.01	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00
copper, total recoverable	Pounds	0.18	0.09	0.02	0.43	0.04	0.02	0.02	0.06	0.17	0.02	0.06	0.08	0.11	0.02
Lead, total recoverable	Pounds	0.41	0.78	0.21	1.29	0.17	0.12	0.09	0.37	0.48	0.16	0.16	0.32	0.30	0.11
Zinc, total recoverable	Pounds	1.27	2.07	0.60	3.46	0.52	0.36	0.29	1.08	1.35	0.44	0.44	0.96	0.87	0.33
Storm runoff	ft^3	192,038	354,782	63,488	729,407	54,117	32,259	23,975	148,417	201,158	42,224	41,970	126,648	109,007	28,356

[1]Add 1 to the value for impervious area, industrial land

RESULTING CONCENTRATIONS															
Chemical oxygen demand	mg / L	106.40	72.46	129.47	58.66	150.28	180.12	198.96	106.86	92.40	148.25	148.71	113.90	115.26	182.34
5-day biological oxygen demand	mg / L	27.66	12.85	34.39	9.17	47.10	64.31	76.09	26.40	20.07	43.20	43.47	29.62	29.47	64.34
Suspended solids	mg / L	220.02	112.70	165.25	105.67	227.97	260.92	278.20	181.76	149.36	179.80	180.63	194.22	178.76	244.42
Dissolved solids	mg / L	59.74	75.11	71.93	73.59	63.87	62.55	62.13	65.57	69.57	71.38	71.28	64.50	67.33	64.74
Nitrogen, total	mg / L	2.26	1.48	2.02	1.38	2.46	2.73	2.88	2.05	1.80	2.17	2.18	2.15	2.06	2.65
Nitrogen, ammonia plus organic, total	mg / L	1.72	1.10	1.46	1.04	1.81	2.00	2.10	1.53	1.34	1.56	1.56	1.60	1.52	1.92
Phosphorus, total	mg / L	0.35	0.27	0.33	0.25	0.38	0.41	0.43	0.33	0.30	0.35	0.35	0.34	0.34	0.40
Phosphorus, dissolved	mg / L	0.03	0.02	0.06	0.01	0.07	0.09	0.11	0.04	0.03	0.08	0.08	0.04	0.04	0.10
Cadmium, total recoverable	mg / L	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
copper, total recoverable	mg / L	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Lead, total recoverable	mg / L	0.03	0.04	0.05	0.03	0.05	0.06	0.06	0.04	0.04	0.06	0.06	0.04	0.04	0.06
Zinc, total recoverable	mg / L	0.11	0.09	0.15	0.08	0.15	0.18	0.19	0.12	0.11	0.17	0.17	0.12	0.13	0.18

INPUT		4600: IBW @ McKellips Rd.																		
Outfall ID		010080	010520	010820	020090	020450	020650	020740	020820	030080	030580	030600	030640	040070	040420	050160	051570	051930	052020	060130
Total storm rainfall [in]	(TRN)	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Drainage Area [mi2]	(DA)	0.27	0.02	0.02	0.42	0.14	0.1	0.11	0.07	0.29	0.38	0.72	0.82	0.55	0.08	1.5	0.12	0.07	0.05	0.37
Impervious area [%]1	(IA)	46.58	55	55	91.06	89.08	47.51	69.3	86	55.01	28.32	15.3	19.89	87.54	84.89	68.04	38.39	36	36	39.32
Land Use - Industrial [%]1	(LUI)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Land Use - Commerical [%]1	(LUC)	2.48	1	1	1	1	1	1	1	1	13.57	6.52	6.75	2.27	1	16.66	2.72	1	1	1
Land Use - Undeveloped [%]1	(LUN)	3.11	1	1	39.5	1	1	1	24.54	1	43.06	70.46	72.78	71.13	30.57	10.86	1	1	1	3.63
Storm Intensity [24hr-2yr]	(INT)	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Mean annual rainfall [in]	(MAR)	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11

STORM RUNOFF CONSTITUENT LOADS																				
Chemical oxygen demand	Pounds	507	116	116	811	423	285	339	278	557	530	636	746	938	300	1,561	297	212	174	579
5-day biological oxygen demand	Pounds	216.76	80.20	80.20	256.61	168.66	148.32	153.82	129.43	222.76	246.99	315.28	331.34	284.46	136.20	417.31	159.02	129.43	113.82	244.48
Suspended solids	Pounds	591	100	100	886	413	298	337	254	636	695	986	1,122	1,062	279	2,046	328	223	177	716
Dissolved solids	Pounds	332.8	36.4	36.4	854.3	311.5	138.1	204.4	162.0	406.3	302.4	326.5	454.3	1,055.2	180.8	2,125.7	136.9	79.9	59.0	385.4
Nitrogen, total	Pounds	8.9	1.4	1.4	15.3	6.8	4.4	5.3	4.1	9.9	9.7	12.7	15.2	18.4	4.5	35.1	4.6	3.1	2.4	10.6
Nitrogen, ammonia plus organic, total	Pounds	5.8	0.9	0.9	9.9	4.4	2.8	3.4	2.6	6.5	6.4	8.5	10.2	12.0	2.9	23.3	3.0	2.0	1.5	7.0
Phosphorus, total	Pounds	1.11	0.16	0.16	2.08	0.89	0.52	0.66	0.51	1.26	1.16	1.45	1.80	2.52	0.56	4.89	0.55	0.35	0.27	1.31
Phosphorus, dissolved	Pounds	0.20	0.09	0.09	0.28	0.19	0.14	0.16	0.15	0.21	0.20	0.21	0.24	0.30	0.15	0.40	0.14	0.12	0.11	0.21
Cadmium, total recoverable	Pounds	0.002	0.000	0.000	0.001	0.002	0.001	0.001	0.000	0.003	0.002	0.002	0.002	0.001	0.000	0.010	0.002	0.001	0.001	0.002
copper, total recoverable	Pounds	0.03	0.00	0.00	0.02	0.01	0.01	0.01	0.01	0.02	0.05	0.06	0.06	0.03	0.01	0.15	0.02	0.01	0.01	0.02
Lead, total recoverable	Pounds	0.16	0.03	0.03	0.33	0.16	0.09	0.12	0.10	0.19	0.15	0.16	0.20	0.38	0.11	0.64	0.09	0.06	0.05	0.18
Zinc, total recoverable	Pounds	0.49	0.10	0.10	0.91	0.44	0.26	0.34	0.28	0.56	0.47	0.52	0.65	1.06	0.30	1.77	0.26	0.18	0.15	0.55
Storm runoff	ft^3	45,500	5,105	5,105	104,010	38,902	19,191	26,699	20,629	54,011	44,467	52,304	69,606	128,593	23,012	264,379	19,615	11,693	8,690	53,795

[1]Add 1 to the value for impervious area, industrial land use, and commercial land use for use in the equation; add 2 to the value for undeveloped areas.

RESULTING CONCENTRATIONS																				
Chemical oxygen demand	mg / L	178.70	364.63	364.63	124.95	174.19	238.10	203.68	216.38	165.38	191.20	195.01	171.69	116.93	208.92	94.66	242.50	290.66	321.06	172.43
5-day biological oxygen demand	mg / L	76.36	251.82	251.82	39.54	69.49	123.88	92.34	100.56	66.11	89.03	96.62	76.30	35.46	94.87	25.30	129.94	177.42	209.93	72.84
Suspended solids	mg / L	208.10	314.29	314.29	136.57	170.23	248.97	202.22	197.73	188.82	250.42	302.16	258.34	132.32	194.03	124.07	267.67	306.36	326.64	213.41
Dissolved solids	mg / L	117.24	114.33	114.33	131.65	128.36	115.31	122.72	125.89	120.57	109.01	100.05	104.60	131.52	125.96	128.87	111.85	109.53	108.80	114.82
Nitrogen, total	mg / L	3.14	4.46	4.46	2.36	2.82	3.64	3.17	3.17	2.94	3.51	3.88	3.49	2.29	3.12	2.13	3.80	4.22	4.45	3.16
Nitrogen, ammonia plus organic, total	mg / L	2.05	2.81	2.81	1.53	1.81	2.35	2.04	2.02	1.92	2.32	2.61	2.34	1.49	1.99	1.41	2.46	2.71	2.85	2.08
Phosphorus, total	mg / L	0.39	0.51	0.51	0.32	0.37	0.43	0.40	0.40	0.37	0.42	0.45	0.41	0.31	0.39	0.30	0.45	0.48	0.50	0.39
Phosphorus, dissolved	mg / L	0.07	0.27	0.27	0.04	0.08	0.12	0.10	0.11	0.06	0.07	0.07	0.05	0.04	0.11	0.02	0.12	0.16	0.19	0.06
Cadmium, total recoverable	mg / L	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.002	0.001	0.001	0.001
copper, total recoverable	mg / L	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.02	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Lead, total recoverable	mg / L	0.06	0.10	0.10	0.05	0.06	0.07	0.07	0.08	0.06	0.05	0.05	0.05	0.05	0.07	0.04	0.07	0.08	0.08	0.05
Zinc, total recoverable	mg / L	0.17	0.32	0.32	0.14	0.18	0.22	0.20	0.22	0.16	0.17	0.16	0.15	0.13	0.21	0.11	0.22	0.25	0.27	0.16

Storm Runoff Constituent Loads, Volumes, and Mean Concentrations for Selected Basins in STP Papago Project Area

Storm: April 21, 1997

INPUT																			*4640: IBW @ Swe*	
Outfall ID		*060600*	*061020*	*061150*	*070120*	*210040*	*210320*	*010080*	*010520*	*010820*	*020090*	*020450*	*020650*	*020740*	*020820*	*030080*	*030580*	*030600*	*030640*	*040070*
Total storm rainfall [in]	(TRN)	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Drainage Area [mi2]	(DA)	0.4	0.05	0.05	0.33	0.22	0.05	0.27	0.02	0.02	0.42	0.14	0.1	0.11	0.07	0.29	0.38	0.72	0.82	0.55
Impervious area [%]1	(IA)	56.41	85.77	84.98	35.99	49.49	46.57	46.58	55	55	91.06	89.08	47.51	69.3	86	55.01	28.32	15.3	19.89	87.54
Land Use - Industrial [%]1	(LUI)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Land Use - Commerical [%]1	(LUC)	13.81	1	36.85	3.15	10.3	1	2.48	1	1	1	1	1	1	1	1	13.57	6.52	6.75	2.27
Land Use - Undeveloped [%]1	(LUN)	2.25	1	1	21.08	1	1	3.11	1	1	39.5	1	1	1	24.54	1	43.06	70.46	72.78	71.13
Storm Intensity [24hr-2yr]	(INT)	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Mean annual rainfall [in]	(MAR)	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11

STORM RUNOFF CONSTITUENT LOADS																				
Chemical oxygen demand	Pounds	678	228	228	526	458	189	507	116	116	811	423	285	339	278	557	530	636	746	938
5-day biological oxygen demand	Pounds	251.87	113.82	113.82	234.03	200.45	113.82	216.76	80.20	80.20	256.61	168.66	148.32	153.82	129.43	222.76	246.99	315.28	331.34	284.46
Suspended solids	Pounds	798	202	201	653	517	184	591	100	100	886	413	298	337	254	636	695	986	1,122	1,062
Dissolved solids	Pounds	554.2	119.4	118.5	323.5	290.6	72.7	332.8	36.4	36.4	854.3	311.5	138.1	204.4	162.0	406.3	302.4	326.5	454.3	1,055.2
Nitrogen, total	Pounds	12.6	3.2	3.2	9.5	7.8	2.6	8.9	1.4	1.4	15.3	6.8	4.4	5.3	4.1	9.9	9.7	12.7	15.2	18.4
Nitrogen, ammonia plus organic, total	Pounds	8.3	2.0	2.0	6.2	5.1	1.7	5.8	0.9	0.9	9.9	4.4	2.8	3.4	2.6	6.5	6.4	8.5	10.2	12.0
Phosphorus, total	Pounds	1.63	0.40	0.39	1.16	0.97	0.30	1.11	0.16	0.16	2.08	0.89	0.52	0.66	0.51	1.26	1.16	1.45	1.80	2.52
Phosphorus, dissolved	Pounds	0.24	0.13	0.13	0.20	0.19	0.11	0.20	0.09	0.09	0.28	0.19	0.14	0.16	0.15	0.21	0.20	0.21	0.24	0.30
Cadmium, total recoverable	Pounds	0.006	0.001	0.002	0.001	0.005	0.001	0.002	0.000	0.000	0.001	0.002	0.001	0.001	0.000	0.003	0.002	0.002	0.002	0.001
copper, total recoverable	Pounds	0.06	0.01	0.02	0.03	0.04	0.01	0.03	0.00	0.00	0.02	0.01	0.01	0.01	0.01	0.02	0.05	0.06	0.06	0.03
Lead, total recoverable	Pounds	0.24	0.08	0.08	0.16	0.15	0.05	0.16	0.03	0.03	0.33	0.16	0.09	0.12	0.10	0.19	0.15	0.16	0.20	0.38
Zinc, total recoverable	Pounds	0.69	0.23	0.23	0.49	0.44	0.17	0.49	0.10	0.10	0.91	0.44	0.26	0.34	0.28	0.56	0.47	0.52	0.65	1.06
Storm runoff	ft^3	72,911	15,304	15,212	45,904	39,510	10,278	45,500	5,105	5,105	104,010	38,902	19,191	26,699	20,629	54,011	44,467	52,304	69,606	128,593

[1]Add 1 to the value for impervious area, industrial lan

RESULTING CONCENTRATIONS																				
Chemical oxygen demand	mg / L	149.10	239.23	239.98	183.79	186.00	294.23	178.70	364.63	364.63	124.95	174.19	238.10	203.68	216.38	165.38	191.20	195.01	171.69	116.93
5-day biological oxygen demand	mg / L	55.37	119.20	119.92	81.71	81.32	177.50	76.36	251.82	251.82	39.54	69.49	123.88	92.34	100.56	66.11	89.03	96.62	76.30	35.46
Suspended solids	mg / L	175.37	211.10	212.09	228.03	209.89	286.98	208.10	314.29	314.29	136.57	170.23	248.97	202.22	197.73	188.82	250.42	302.16	258.34	132.32
Dissolved solids	mg / L	121.83	125.00	124.81	112.95	117.90	113.37	117.24	114.33	114.33	131.65	128.36	115.31	122.72	125.89	120.57	109.01	100.05	104.60	131.52
Nitrogen, total	mg / L	2.78	3.35	3.36	3.31	3.18	4.09	3.14	4.46	4.46	2.36	2.82	3.64	3.17	3.17	2.94	3.51	3.88	3.49	2.29
Nitrogen, ammonia plus organic, total	mg / L	1.82	2.12	2.12	2.18	2.07	2.61	2.05	2.81	2.81	1.53	1.81	2.35	2.04	2.02	1.92	2.32	2.61	2.34	1.49
Phosphorus, total	mg / L	0.36	0.41	0.41	0.40	0.39	0.47	0.39	0.51	0.51	0.32	0.37	0.43	0.40	0.40	0.37	0.42	0.45	0.41	0.31
Phosphorus, dissolved	mg / L	0.05	0.14	0.14	0.07	0.08	0.17	0.07	0.27	0.27	0.04	0.08	0.12	0.10	0.11	0.06	0.07	0.07	0.05	0.04
Cadmium, total recoverable	mg / L	0.001	0.001	0.002	0.000	0.002	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.000
copper, total recoverable	mg / L	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.02	0.02	0.01	0.00
Lead, total recoverable	mg / L	0.05	0.08	0.08	0.06	0.06	0.08	0.06	0.10	0.10	0.05	0.06	0.07	0.07	0.08	0.06	0.05	0.05	0.05	0.05
Zinc, total recoverable	mg / L	0.15	0.24	0.24	0.17	0.18	0.26	0.17	0.32	0.32	0.14	0.18	0.22	0.20	0.22	0.16	0.17	0.16	0.15	0.13

Storm Runoff Constituent Loads, Volumes, and Mean Concentrations for Selected Basins in STP Papago Project Area

Storm: April 21, 1997

INPUT		etwater											
Outfall ID		040420	050160	051570	051930	052020	060130	060600	061020	061150	070120	210040	210320
Total storm rainfall [in]	(TRN)	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Drainage Area [mi2]	(DA)	0.08	1.5	0.12	0.07	0.05	0.37	0.4	0.05	0.05	0.33	0.22	0.05
Impervious area [%]1	(IA)	84.89	68.04	38.39	36	36	39.32	56.41	85.77	84.98	35.99	49.49	46.57
Land Use - Industrial [%]1	(LUI)	1	1	1	1	1	1	1	1	1	1	1	1
Land Use - Commerical [%]1	(LUC)	1	16.66	2.72	1	1	1	13.81	1	36.85	3.15	10.3	1
Land Use - Undeveloped [%]1	(LUN)	30.57	10.86	1	1	1	3.63	2.25	1	1	21.08	1	1
Storm Intensity [24hr-2yr]	(INT)	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Mean annual rainfall [in]	(MAR)	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11	7.11

STORM RUNOFF CONSTITUENT LOADS													
Chemical oxygen demand	Pounds	300	1,561	297	212	174	579	678	228	228	526	458	189
5-day biological oxygen demand	Pounds	136.20	417.31	159.02	129.43	113.82	244.48	251.87	113.82	113.82	234.03	200.45	113.82
Suspended solids	Pounds	279	2,046	328	223	177	716	798	202	201	653	517	184
Dissolved solids	Pounds	180.8	2,125.7	136.9	79.9	59.0	385.4	554.2	119.4	118.5	323.5	290.6	72.7
Nitrogen, total	Pounds	4.5	35.1	4.6	3.1	2.4	10.6	12.6	3.2	3.2	9.5	7.8	2.6
Nitrogen, ammonia plus organic, total	Pounds	2.9	23.3	3.0	2.0	1.5	7.0	8.3	2.0	2.0	6.2	5.1	1.7
Phosphorus, total	Pounds	0.56	4.89	0.55	0.35	0.27	1.31	1.63	0.40	0.39	1.16	0.97	0.30
Phosphorus, dissolved	Pounds	0.15	0.40	0.14	0.12	0.11	0.21	0.24	0.13	0.13	0.20	0.19	0.11
Cadmium, total recoverable	Pounds	0.000	0.010	0.002	0.001	0.001	0.002	0.006	0.001	0.002	0.001	0.005	0.001
copper, total recoverable	Pounds	0.01	0.15	0.02	0.01	0.01	0.02	0.06	0.01	0.02	0.03	0.04	0.01
Lead, total recoverable	Pounds	0.11	0.64	0.09	0.06	0.05	0.18	0.24	0.08	0.08	0.16	0.15	0.05
Zinc, total recoverable	Pounds	0.30	1.77	0.26	0.18	0.15	0.55	0.69	0.23	0.23	0.49	0.44	0.17
Storm runoff	ft^3	23,012	264,379	19,615	11,693	8,690	53,795	72,911	15,304	15,212	45,904	39,510	10,278

[1]Add 1 to the value for impervious area, industrial lan

RESULTING CONCENTRATIONS													
Chemical oxygen demand	mg / L	208.92	94.66	242.50	290.66	321.06	172.43	149.10	239.23	239.98	183.79	186.00	294.23
5-day biological oxygen demand	mg / L	94.87	25.30	129.94	177.42	209.93	72.84	55.37	119.20	119.92	81.71	81.32	177.50
Suspended solids	mg / L	194.03	124.07	267.67	306.36	326.64	213.41	175.37	211.10	212.09	228.03	209.89	286.98
Dissolved solids	mg / L	125.96	128.87	111.85	109.53	108.80	114.82	121.83	125.00	124.81	112.95	117.90	113.37
Nitrogen, total	mg / L	3.12	2.13	3.80	4.22	4.45	3.16	2.78	3.35	3.36	3.31	3.18	4.09
Nitrogen, ammonia plus organic, total	mg / L	1.99	1.41	2.46	2.71	2.85	2.08	1.82	2.12	2.12	2.18	2.07	2.61
Phosphorus, total	mg / L	0.39	0.30	0.45	0.48	0.50	0.39	0.36	0.41	0.41	0.40	0.39	0.47
Phosphorus, dissolved	mg / L	0.11	0.02	0.12	0.16	0.19	0.06	0.05	0.14	0.14	0.07	0.08	0.17
Cadmium, total recoverable	mg / L	0.000	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.002	0.000	0.002	0.001
copper, total recoverable	mg / L	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.01
Lead, total recoverable	mg / L	0.07	0.04	0.07	0.08	0.08	0.05	0.05	0.08	0.08	0.06	0.06	0.08
Zinc, total recoverable	mg / L	0.21	0.11	0.22	0.25	0.27	0.16	0.15	0.24	0.24	0.17	0.18	0.26

Chain of Custody / Documentation of Lab Results

NEL LABORATORIES
Reno • Las Vegas
Phoenix • Burbank

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

RECEIVED
AUG 21 1997
KIMLEY - HORN & ASSOC.
PHOENIX, AZ

CLIENT: Kimley-Horn
7600 N. 15th St. #250
Phoenix, AZ 85020
ATTN: Bruce Wilcox

PROJECT NAME: Kimley-Horn: MCFCD
PROJECT #: NA

NEL ORDER ID: P9708007

Attached are the analytical results for samples in support of the above referenced project.

Samples submitted for this project were not sampled by NEL Laboratories. Samples were received by NEL in good condition, under chain of custody on 8/6/97.

Samples were analyzed as received.

Where applicable we have included the following quality control data:

Method blank - used to demonstrate absence of contamination or interferences in the analytical process.
Laboratory Control Spike (LCS) - used to demonstrate laboratory ability to perform the method within specifications by spiking representative analytes into a clean matrix.
Surrogates - compounds added to each sample to ensure that the method requirements are met for each individual sample.

Should you have any questions or comments, please feel free to contact our Client Services department at (602) 437-0099.

Due to shipping problems, extractions for Methods 608 and 625 were performed beyond the holding time.

Some results have been flagged as follows:

LA - Analysis performed by NEL Burbank.
LV - Analysis performed by NEL Las Vegas.

Eileen M. Ferguson
Eileen M. Ferguson
Laboratory Manager

8/15/97
Date

CERTIFICATIONS:

	Reno	Las Vegas	Burbank
Arizona	AZ0520	AZ0518	AZ0325
California	1707	2002	1192
US Army Corps of Engineers	Certified	Certified	Certified

	Reno	Las Vegas	Burbank
Idaho	Certified	Certified	
Montana	Certified	Certified	
Nevada	NV033	NV052	CA084
Washington			Certified

NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	LOCATION #5-1
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-01
TEST:	**Semi-Volatile Organic Compounds by EPA 625, July 1993**		
METHOD:	EPA 625	EXTRACTED:	8/11/97
MATRIX:	Aqueous	ANALYZED:	8/13/97
DILUTION:	1	ANALYST:	DH

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acenaphthene	ND	10. µg/L	Hexachlorobutadiene	ND	10. µg/L
Acenaphthylene	ND	10. µg/L	Hexachloroethane	ND	10. µg/L
Anthracene	ND	10. µg/L	Hexachlorocyclopentadiene	ND	10. µg/L
Benzo (a) anthracene	ND	10. µg/L	Indeno (1,2,3-c,d) pyrene	ND	10. µg/L
Benzo (b&k) fluoranthene	ND	10. µg/L	Isophorone	ND	10. µg/L
Benzo (a) pyrene	ND	10. µg/L	4,6-Dinitro-2-methyl phenol	ND	10. µg/L
Benzo (g,h,i) perylene	ND	10. µg/L	Naphthalene	ND	10. µg/L
Butylbenzylphthalate	ND	10. µg/L	Nitrobenzene	ND	10. µg/L
bis (2-Chloroethyl) ether	ND	10. µg/L	2-Nitrophenol	ND	10. µg/L
bis (2-Chloroethoxy) methane	ND	10. µg/L	4-Nitrophenol	ND	10. µg/L
bis (2-chloroisopropyl) ether	ND	10. µg/L	N-Nitrosodi-n-propylamine	ND	10. µg/L
bis (2-Ethylhexyl)phthalate	ND	10. µg/L	N-Nitroso-Dimethylamine	ND	10. µg/L
4-Bromophenyl phenyl ether	ND	50. µg/L	N-Nitrosodiphenylamine	ND	10. µg/L
4-Chloro-3-methyl phenol	ND	10. µg/L	Pentachlorophenol	ND	10. µg/L
2-Chloronaphthalene	ND	10. µg/L	Phenol	ND	10. µg/L
2-Chlorophenol	ND	10. µg/L	Phenanthrene	ND	50. µg/L
4-Chlorophenyl phenyl ether	ND	20. µg/L	Pyrene	ND	10. µg/L
Chrysene	ND	10. µg/L	1,2,4-Trichlorobenzene	ND	10. µg/L
Dibenz [a,h] Anthracene	ND	10. µg/L	2,4,6-Trichlorophenol	ND	10. µg/L
Di-n-butyl phthalate	ND	10. µg/L			
1,2-Dichlorobenzene (o-DCB)	ND	10. µg/L			
1,3-Dichlorobenzene (m-DCB)	ND	10. µg/L			
1,4-Dichlorobenzene (p-DCB)	ND	10. µg/L			
2,4-Dichlorophenol	ND	10. µg/L			
3,3'-Dichlorobenzidine	ND	10. µg/L			
Diethylphthalate	ND	10. µg/L			
2,4-Dimethylphenol	ND	10. µg/L			
Dimethylphthalate	ND	10. µg/L			
2,4-Dinitrotoluene	ND	50. µg/L			
2,6-Dinitrotoluene	ND	10. µg/L			
2,4-Dinitrophenol	ND	10. µg/L			
Di-n-octyl phthalate	ND	10. µg/L			
Fluoranthene	ND	10. µg/L			
Fluorene	ND	10. µg/L			
Hexachlorobenzene	ND	10. µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
2,4,6-Tribromophenol	65	33 - 141
2-Fluorobiphenyl	57	43 - 116
2-Fluorophenol	28	21 - 100
Nitrobenzene-d5	63	35 - 114
p-Terphenyl-d14	66	33 - 141
Phenol-d5	24	10 - 94

ND - Not Detected

This report shall not be reproduced except in full, without the written approval of the laboratory.

NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	LOCATION #6-1
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-02

TEST:	**Semi-Volatile Organic Compounds by EPA 625, July 1993**		
METHOD:	EPA 625	EXTRACTED:	8/11/97
MATRIX:	Aqueous	ANALYZED:	8/13/97
DILUTION:	1	ANALYST:	DH

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acenaphthene	ND	10. µg/L	Hexachlorobutadiene	ND	10. µg/L
Acenaphthylene	ND	10. µg/L	Hexachloroethane	ND	10. µg/L
Anthracene	ND	10. µg/L	Hexachlorocyclopentadiene	ND	10. µg/L
Benzo (a) anthracene	ND	10. µg/L	Indeno (1,2,3-c,d) pyrene	ND	10. µg/L
Benzo (b&k) fluoranthene	ND	10. µg/L	Isophorone	ND	10. µg/L
Benzo (a) pyrene	ND	10. µg/L	4,6-Dinitro-2-methyl phenol	ND	10. µg/L
Benzo (g,h,i) perylene	ND	10. µg/L	Naphthalene	ND	10. µg/L
Butylbenzylphthalate	ND	10. µg/L	Nitrobenzene	ND	10. µg/L
bis (2-Chloroethyl) ether	ND	10. µg/L	2-Nitrophenol	ND	10. µg/L
bis (2-Chloroethoxy) methane	ND	10. µg/L	4-Nitrophenol	ND	10. µg/L
bis (2-chloroisopropyl) ether	ND	10. µg/L	N-Nitrosodi-n-propylamine	ND	10. µg/L
bis (2-Ethylhexyl)phthalate	ND	10. µg/L	N-Nitroso-Dimethylamine	ND	10. µg/L
4-Bromophenyl phenyl ether	ND	50. µg/L	N-Nitrosodiphenylamine	ND	10. µg/L
4-Chloro-3-methyl phenol	ND	10. µg/L	Pentachlorophenol	ND	10. µg/L
2-Chloronaphthalene	ND	10. µg/L	Phenol	ND	10. µg/L
2-Chlorophenol	ND	10. µg/L	Phenanthrene	ND	50. µg/L
4-Chlorophenyl phenyl ether	ND	20. µg/L	Pyrene	ND	10. µg/L
Chrysene	ND	10. µg/L	1,2,4-Trichlorobenzene	ND	10. µg/L
Dibenz [a,h] Anthracene	ND	10. µg/L	2,4,6-Trichlorophenol	ND	10. µg/L
Di-n-butyl phthalate	ND	10. µg/L			
1,2-Dichlorobenzene (o-DCB)	ND	10. µg/L			
1,3-Dichlorobenzene (m-DCB)	ND	10. µg/L			
1,4-Dichlorobenzene (p-DCB)	ND	10. µg/L			
2,4-Dichlorophenol	ND	10. µg/L			
3,3'-Dichlorobenzidine	ND	10. µg/L			
Diethylphthalate	ND	10. µg/L			
2,4-Dimethylphenol	ND	10. µg/L			
Dimethylphthalate	ND	10. µg/L			
2,4-Dinitrotoluene	ND	50. µg/L			
2,6-Dinitrotoluene	ND	10. µg/L			
2,4-Dinitrophenol	ND	10. µg/L			
Di-n-octyl phthalate	ND	10. µg/L			
Fluoranthene	ND	10. µg/L			
Fluorene	ND	10. µg/L			
Hexachlorobenzene	ND	10. µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
2,4,6-Tribromophenol	74	33 - 141
2-Fluorobiphenyl	57	43 - 116
2-Fluorophenol	29	21 - 100
Nitrobenzene-d5	57	35 - 114
p-Terphenyl-d14	76	33 - 141
Phenol-d5	24	10 - 94

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Method Blank**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	081197-E3-BLK
TEST:	**Semi-Volatile Organic Compounds by EPA 625, July 1993**		
METHOD:	EPA 625	ANALYST:	DH
MATRIX:	Aqueous	EXTRACTED:	8/11/97
		ANALYZED:	8/13/97

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acenaphthene	ND	10 µg/L	Hexachlorobenzene	ND	10 µg/L
Acenaphthylene	ND	10 µg/L	Hexachlorobutadiene	ND	10 µg/L
Anthracene	ND	10 µg/L	Hexachloroethane	ND	10 µg/L
Benzo (a) anthracene	ND	10 µg/L	Hexachlorocyclopentadiene	ND	10 µg/L
Benzo (b&k) fluoranthene	ND	10 µg/L	Indeno (1,2,3-c,d) pyrene	ND	10 µg/L
Benzo (a) pyrene	ND	10 µg/L	Isophorone	ND	10 µg/L
Benzo (g,h,i) perylene	ND	10 µg/L	4,6-Dinitro-2-methyl phenol	ND	10 µg/L
Butylbenzylphthalate	ND	10 µg/L	Naphthalene	ND	10 µg/L
bis (2-Chloroethyl) ether	ND	10 µg/L	Nitrobenzene	ND	10 µg/L
bis (2-Chloroethoxy) methane	ND	10 µg/L	2-Nitrophenol	ND	10 µg/L
bis (2-chloroisopropyl) ether	ND	10 µg/L	4-Nitrophenol	ND	10 µg/L
bis (2-Ethylhexyl)phthalate	ND	10 µg/L	N-Nitrosodi-n-propylamine	ND	10 µg/L
4-Bromophenyl phenyl ether	ND	50 µg/L	N-Nitroso-Dimethylamine	ND	10 µg/L
4-Chloro-3-methyl phenol	ND	10 µg/L	N-Nitrosodiphenylamine	ND	10 µg/L
2-Chloronaphthalene	ND	10 µg/L	Pentachlorophenol	ND	10 µg/L
2-Chlorophenol	ND	10 µg/L	Phenol	ND	10 µg/L
4-Chlorophenyl phenyl ether	ND	20 µg/L	Phenanthrene	ND	50 µg/L
Chrysene	ND	10 µg/L	Pyrene	ND	10 µg/L
Dibenz [a,h] Anthracene	ND	10 µg/L	1,2,4-Trichlorobenzene	ND	10 µg/L
Di-n-butyl phthalate	ND	10 µg/L	2,4,6-Trichlorophenol	ND	10 µg/L
1,2-Dichlorobenzene (o-DCB)	ND	10 µg/L			
1,3-Dichlorobenzene (m-DCB)	ND	10 µg/L			
1,4-Dichlorobenzene (p-DCB)	ND	10 µg/L			
2,4-Dichlorophenol	ND	10 µg/L			
3,3'-Dichlorobenzidine	ND	10 µg/L			
Diethylphthalate	ND	10 µg/L			
2,4-Dimethylphenol	ND	10 µg/L			
Dimethylphthalate	ND	10 µg/L			
2,4-Dinitrotoluene	ND	50 µg/L			
2,6-Dinitrotoluene	ND	10 µg/L			
2,4-Dinitrophenol	ND	10 µg/L			
Di-n-octyl phthalate	ND	10 µg/L			
Fluoranthene	ND	10 µg/L			
Fluorene	ND	10 µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
2,4,6-Tribromophenol	69	33 - 141
2-Fluorobiphenyl	76	43 - 116
2-Fluorophenol	42	21 - 100
Nitrobenzene-d5	77	35 - 114
p-Terphenyl-d14	94	33 - 141
Phenol-d5	30	10 - 94

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #5-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-01
TEST:	**Priority 13 Metals**		
MATRIX:	Aqueous	ANALYST:	JL

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Copper	0.036	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Lead	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	8/11/97	8/11/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	8/11/97	8/11/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Silver	ND	0.02 mg/L	1	EPA 6010A	8/11/97	8/11/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	8/11/97	8/11/97
Zinc	0.19	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #6-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-02
TEST:	**Priority 13 Metals**		
MATRIX:	Aqueous	ANALYST:	JL

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Copper	0.020	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Lead	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	8/11/97	8/11/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	8/11/97	8/11/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Silver	ND	0.02 mg/L	1	EPA 6010A	8/11/97	8/11/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	8/11/97	8/11/97
Zinc	0.11	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Method Blank**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	L08036-BLK
TEST:	**Priority 13 Metals**		

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Mercury	ND	0.0002 mg/L	1	EPA 7470A	8/11/97	8/11/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
PROJECT #: NA

CLIENT ID: **Method Blank**
DATE SAMPLED: NA
NEL SAMPLE ID: L9708036-BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Aluminum	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Antimony	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Barium	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Boron	ND	0.02 mg/L	1	EPA 6010A	8/11/97	8/11/97
Cadmium	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Calcium	ND	0.5 mg/L	1	EPA 6010A	8/11/97	8/11/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Cobalt	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Copper	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Iron	ND	0.02 mg/L	1	EPA 6010A	8/11/97	8/11/97
Lead	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Magnesium	ND	0.2 mg/L	1	EPA 6010A	8/11/97	8/11/97
Manganese	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Molybdenum	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Nickel	ND	0.04 mg/L	1	EPA 6010A	8/11/97	8/11/97
Potassium	ND	2 mg/L	1	EPA 6010A	8/11/97	8/11/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	8/11/97	8/11/97
Silver	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97
Sodium	ND	0.5 mg/L	1	EPA 6010A	8/11/97	8/11/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	8/11/97	8/11/97
Titanium	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Vanadium	ND	0.005 mg/L	1	EPA 6010A	8/11/97	8/11/97
Zinc	ND	0.01 mg/L	1	EPA 6010A	8/11/97	8/11/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #5-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-01
TEST:	**Inorganic Non-Metals**		
MATRIX:	Aqueous		

PARAMETER	RESULT		REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
COD	244	LA	10.	1	410.1	mg/L	8/13/97
Oil & Grease	4.0	LV	1.	1	EPA 413.1	mg/L	8/12/97
Sulfate	24	LV	1.	10	EPA 300.0	mg/L	8/12/97
Total Cyanide	ND	LV	0.02	1	SM 4500-CN G	mg/L	8/13/97
Total Phosphorous	0.57	LV	0.04	4	SM 4500-P E	mg/L-P	8/11/97
Total Suspended Solids	43.8	LV	5.2	2.6	SM 2540 D	mg/L	8/6/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #6-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-02
TEST:	**Inorganic Non-Metals**		
MATRIX:	Aqueous		

PARAMETER	RESULT		REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
COD	124	LA	10.	1	410.1	mg/L	8/13/97
Oil & Grease	3.8	LV	1.	1	EPA 413.1	mg/L	8/12/97
Sulfate	7	LV	1.	10	EPA 300.0	mg/L	8/12/97
Total Cyanide	ND	LV	0.02	1	SM 4500-CN G	mg/L	8/13/97
Total Phosphorous	0.28	LV	0.01	1	SM 4500-P E	mg/L-P	8/11/97
Total Suspended Solids	39	LV	5.	2.5	SM 2540 D	mg/L	8/6/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #5-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-01
TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
METHOD:	EPA 608	ANALYST:	YW
MATRIX:	Aqueous	EXTRACTED:	8/12/97
DILUTION:	1	ANALYZED:	8/15/97

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	ND	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	ND	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Chlordane	ND	0.5 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Lindane (gamma-BHC)	ND	0.1 µg/L
Methoxychlor	ND	0.5 µg/L
Toxaphene	ND	2. µg/L
Arochlor-1016	ND	0.5 µg/L
Arochlor-1221	ND	0.5 µg/L
Arochlor-1232	ND	0.5 µg/L
Arochlor-1242	ND	0.5 µg/L
Arochlor-1248	ND	0.5 µg/L
Arochlor-1254	ND	0.5 µg/L
Arochlor-1260	ND	0.5 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	77	70 - 130
Tetrachloro-m-xylene	75	70 - 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #6-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-02
TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
METHOD:	EPA 608	ANALYST:	YW
MATRIX:	Aqueous	EXTRACTED:	8/12/97
DILUTION:	1	ANALYZED:	8/15/97

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	ND	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	ND	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Chlordane	ND	0.5 µg/L
4'-DDD	ND	0.1 µg/L
4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Lindane (gamma-BHC)	ND	0.1 µg/L
Methoxychlor	ND	0.5 µg/L
Toxaphene	ND	2. µg/L
Arochlor-1016	ND	0.5 µg/L
Arochlor-1221	ND	0.5 µg/L
Arochlor-1232	ND	0.5 µg/L
Arochlor-1242	ND	0.5 µg/L
Arochlor-1248	ND	0.5 µg/L
Arochlor-1254	ND	0.5 µg/L
Arochlor-1260	ND	0.5 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	81	70 - 130
Tetrachloro-m-xylene	81	70 - 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #5-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-01
TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
METHOD:	EPA 624	ANALYST:	EF
MATRIX:	Aqueous	EXTRACTED:	8/7/97
DILUTION:	1	ANALYZED:	8/7/97

PARAMETER	Result	Reporting Limit
Benzene	ND LV	5. µg/L
Bromodichloromethane	ND	5. µg/L
Bromoform	ND	5. µg/L
Bromomethane	ND	5. µg/L
Carbon tetrachloride	ND	5. µg/L
Chlorobenzene	ND	5. µg/L
Chloroethane	ND	5. µg/L
2-Chloroethylvinyl ether	ND	5. µg/L
Chloroform	ND	5. µg/L
Chloromethane	ND	5. µg/L
Dibromochloromethane	ND	5. µg/L
cis-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5. µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5. µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5. µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5. µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5. µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5. µg/L
trans-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichloropropane	ND	5. µg/L
cis-1,3-Dichloropropene	ND	5. µg/L
trans-1,3-Dichloropropene	ND	5. µg/L
Ethylbenzene	ND	5. µg/L
Methylene chloride (Dichloromethane)	ND	5. µg/L
1,1,2,2-Tetrachloroethane	ND	5. µg/L
Tetrachloroethene (PCE)	ND	5. µg/L
Toluene	ND	5. µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5. µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5. µg/L
Trichloroethene (TCE)	ND	5. µg/L
Trichlorofluoromethane (Freon 11)	ND	5. µg/L
Vinyl chloride	ND	5. µg/L
m,p-Xylene	ND	5. µg/L
o-Xylene	ND	5. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	103	86 - 115
Dibromofluoromethane	106	86 - 118
Toluene-d8	106	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**LOCATION #6-1**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/6/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-02
TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
METHOD:	EPA 624	ANALYST:	EF
MATRIX:	Aqueous	EXTRACTED:	8/7/97
DILUTION:	1	ANALYZED:	8/7/97

PARAMETER	Result	Reporting Limit
Benzene	ND LV	5. µg/L
Bromodichloromethane	ND	5. µg/L
Bromoform	ND	5. µg/L
Bromomethane	ND	5. µg/L
Carbon tetrachloride	ND	5. µg/L
Chlorobenzene	ND	5. µg/L
Chloroethane	ND	5. µg/L
2-Chloroethylvinyl ether	ND	5. µg/L
Chloroform	ND	5. µg/L
Chloromethane	ND	5. µg/L
Dibromochloromethane	ND	5. µg/L
cis-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5. µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5. µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5. µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5. µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5. µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5. µg/L
trans-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichloropropane	ND	5. µg/L
cis-1,3-Dichloropropene	ND	5. µg/L
trans-1,3-Dichloropropene	ND	5. µg/L
Ethylbenzene	ND	5. µg/L
Methylene chloride (Dichloromethane)	ND	5. µg/L
1,1,2,2-Tetrachloroethane	ND	5. µg/L
Tetrachloroethene (PCE)	ND	5. µg/L
Toluene	ND	5. µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5. µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5. µg/L
Trichloroethene (TCE)	ND	5. µg/L
Trichlorofluoromethane (Freon 11)	ND	5. µg/L
Vinyl chloride	ND	5. µg/L
m,p-Xylene	ND	5. µg/L
o-Xylene	ND	5. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	102	86 - 115
Dibromofluoromethane	105	86 - 118
Toluene-d8	105	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Travel Blank**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	8/7/97
PROJECT #:	NA	NEL SAMPLE ID:	P9708007-03
TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
METHOD:	EPA 624	ANALYST:	EF
MATRIX:	Aqueous	EXTRACTED:	8/7/97
DILUTION:	1	ANALYZED:	8/7/97

PARAMETER	Result	Reporting Limit
Benzene	ND LV	5. µg/L
Bromodichloromethane	ND	5. µg/L
Bromoform	ND	5. µg/L
Bromomethane	ND	5. µg/L
Carbon tetrachloride	ND	5. µg/L
Chlorobenzene	ND	5. µg/L
Chloroethane	ND	5. µg/L
2-Chloroethylvinyl ether	ND	5. µg/L
Chloroform	ND	5. µg/L
Chloromethane	ND	5. µg/L
Dibromochloromethane	ND	5. µg/L
cis-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5. µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5. µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5. µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5. µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5. µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5. µg/L
trans-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichloropropane	ND	5. µg/L
cis-1,3-Dichloropropene	ND	5. µg/L
trans-1,3-Dichloropropene	ND	5. µg/L
Ethylbenzene	ND	5. µg/L
Methylene chloride (Dichloromethane)	ND	5. µg/L
1,1,2,2-Tetrachloroethane	ND	5. µg/L
Tetrachloroethene (PCE)	ND	5. µg/L
Toluene	ND	5. µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5. µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5. µg/L
Trichloroethene (TCE)	ND	5. µg/L
Trichlorofluoromethane (Freon 11)	ND	5. µg/L
Vinyl chloride	ND	5. µg/L
m,p-Xylene	ND	5. µg/L
o-Xylene	ND	5. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	104	86 - 115
Dibromofluoromethane	106	86 - 118
Toluene-d8	106	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Method Blank**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	080797VOA-LV-BLK
TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
METHOD:	EPA 624	ANALYST:	EF
MATRIX:	Aqueous	EXTRACTED:	8/7/97
		ANALYZED:	8/7/97

PARAMETER	Result	Reporting Limit
Benzene	ND	5. µg/L
Bromodichloromethane	ND	5. µg/L
Bromoform	ND	5. µg/L
Bromomethane	ND	5. µg/L
Carbon tetrachloride	ND	5. µg/L
Chlorobenzene	ND	5. µg/L
Chloroethane	ND	5. µg/L
2-Chloroethylvinyl ether	ND	5. µg/L
Chloroform	ND	5. µg/L
Chloromethane	ND	5. µg/L
Dibromochloromethane	ND	5. µg/L
cis-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5. µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5. µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5. µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5. µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5. µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5. µg/L
trans-1,2-Dichloroethene	ND	5. µg/L
1,2-Dichloropropane	ND	5. µg/L
cis-1,3-Dichloropropene	ND	5. µg/L
trans-1,3-Dichloropropene	ND	5. µg/L
Ethylbenzene	ND	5. µg/L
Methylene chloride (Dichloromethane)	ND	5. µg/L
1,1,2,2-Tetrachloroethane	ND	5. µg/L
Tetrachloroethene (PCE)	ND	5. µg/L
Toluene	ND	5. µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5. µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5. µg/L
Trichloroethene (TCE)	ND	5. µg/L
Trichlorofluoromethane (Freon 11)	ND	5. µg/L
Vinyl chloride	ND	5. µg/L
m,p-Xylene	ND	5. µg/L
o-Xylene	ND	5. µg/L
Methyl-t-butyl ether (MTBE)	ND	5. µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	102	86 - 115
Dibromofluoromethane	108	86 - 118
Toluene-d8	107	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Method Blank**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	081297-E1608-BLK
TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
METHOD:	EPA 608	ANALYST:	YW
MATRIX:	Aqueous	EXTRACTED:	8/12/97
		ANALYZED:	8/14/97

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	ND	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	ND	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Chlordane	ND	0.5 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Lindane (gamma-BHC)	ND	0.1 µg/L
Methoxychlor	ND	0.5 µg/L
Toxaphene	ND	2. µg/L
Arochlor-1016	ND	0.5 µg/L
Arochlor-1221	ND	0.5 µg/L
Arochlor-1232	ND	0.5 µg/L
Arochlor-1242	ND	0.5 µg/L
Arochlor-1248	ND	0.5 µg/L
Arochlor-1254	ND	0.5 µg/L
Arochlor-1260	ND	0.5 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	95	70 - 130
Tetrachloro-m-xylene	73	70 - 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Laboratory Control Spike**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	081197-E3-LCS
TEST:	**Semi-Volatile Organic Compounds by EPA 625, July 1993**		
MATRIX:	Aqueous	ANALYST:	EF
		EXTRACTED:	8/11/97
		ANALYZED:	8/13/97

PARAMETER	Percent Recovery	Acceptable Range
Acenaphthene	81	60 - 132
Acenaphthylene	82	54 - 126
Anthracene	92	43 - 118
Benzo (a) anthracene	84	42 - 133
Benzo (b&k) fluoranthene	77	25 - 145
Benzo (a) pyrene	80	32 - 148
Benzo (g,h,i) perylene	72	0 - 195
Butylbenzylphthalate	78	0 - 140
bis (2-Chloroethyl) ether	68	43 - 126
bis (2-Chloroethoxy) methane	78	49 - 165
bis (2-chloroisopropyl) ether	80	63 - 139
bis (2-Ethylhexyl)phthalate	85	29 - 137
4-Bromophenyl phenyl ether	100	65 - 114
4-Chloro-3-methyl phenol	80	41 - 128
2-Chloronaphthalene	82	65 - 114
2-Chlorophenol	70	36 - 120
4-Chlorophenyl phenyl ether	82	48 - 145
Chrysene	83	44 - 140
Dibenz [a,h] Anthracene	68	0 - 200
Di-n-butyl phthalate	82	8 - 111
1,2-Dichlorobenzene (o-DCB)	64	49 - 112
1,3-Dichlorobenzene (m-DCB)	59	17 - 154
1,4-Dichlorobenzene (p-DCB)	62	37 - 106
2,4-Dichlorophenol	81	53 - 122
3,3'-Dichlorobenzidine	90	8 - 213
Diethylphthalate	68	0 - 100
2,4-Dimethylphenol	66	42 - 109
Dimethylphthalate	42	0 - 100
2,4-Dinitrotoluene	89	48 - 127
2,6-Dinitrotoluene	83	68 - 137
2,4-Dinitrophenol	81	0 - 173
Di-n-octyl phthalate	81	19 - 132
Fluoranthene	83	43 - 121
Fluorene	80	72 - 108
Hexachlorobenzene	88	8 - 142
Hexachlorobutadiene	67	38 - 102
Hexachloroethane	61	55 - 100
Hexachlorocyclopentadiene	42	0 - 1000
Indeno (1,2,3-c,d) pyrene	73	0 - 151
Isophorone	79	47 - 180
4,6-Dinitro-2-methyl phenol	81	53 - 100
Naphthalene	75	36 - 120
Nitrobenzene	76	54 - 158
4-Nitrophenol	73	45 - 167

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Laboratory Control Spike**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	081197-E3-LCS
TEST:	**Semi-Volatile Organic Compounds by EPA 625, July 1993**		
MATRIX:	Aqueous	ANALYST:	EF
		EXTRACTED:	8/11/97
		ANALYZED:	8/13/97

PARAMETER	Percent Recovery	Acceptable Range
-Nitrophenol	34	13 - 107
N-Nitrosodi-n-propylamine	77	14 - 198
N-Nitroso-Dimethylamine	50	0 - 1000
-Nitrosodiphenylamine	92	0 - 1000
Pentachlorophenol	89	38 - 152
Phenol	37	17 - 100
henanthrene	87	65 - 109
yrene	82	70 - 100
1,2,4-Trichlorobenzene	68	57 - 129
4,6-Trichlorophenol	76	52 - 129

QUALITY CONTROL DATA:

urrogate	Percent Recovery	Acceptable Range
2,4,6-Tribromophenol	79	33 - 141
-Fluorobiphenyl	82	43 - 116
-Fluorophenol	45	21 - 100
Nitrobenzene-d5	77	35 - 114
p-Terphenyl-d14	82	33 - 141
henol-d5	35	10 - 94

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Laboratory Control Spike**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	081297-E1608-LCS
TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
MATRIX:	Aqueous	ANALYST:	YW
		EXTRACTED:	8/12/97
		ANALYZED:	8/14/97

PARAMETER	Percent Recovery	Acceptable Range
Aldrin	88	42 - 122
alpha-BHC	79	37 - 134
beta-BHC	82	17 - 147
delta-BHC	77	19 - 140
Heptachlor	96	34 - 111
4,4'-DDD	84	31 - 141
4,4'-DDE	118	30 - 145
4,4'-DDT	95	25 - 160
Dieldrin	89	36 - 146
Endosulfan I	79	45 - 153
Endosulfan II	48	1 - 202
Endosulfan sulfate	126	26 - 144
Endrin	85	30 - 147
Heptachlor epoxide	93	37 - 142
Lindane (gamma-BHC)	82	32 - 127

QUALITY CONTROL DATA:

Surrogate	Percent Recovery	Acceptable Range
Decachlorobiphenyl	101	70 - 130
Tetrachloro-m-xylene	73	70 - 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Laboratory Control Spike Duplicate**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	081297-E1608-LCSD
TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
MATRIX:	Aqueous	ANALYST:	YW
		EXTRACTED:	8/12/97
		ANALYZED:	8/14/97

PARAMETER	Percent Recovery	Acceptable Range	RPD
Aldrin	88	42 - 122	0.6
alpha-BHC	81	37 - 134	3.1
beta-BHC	84	17 - 147	2.4
delta-BHC	78	19 - 140	1.3
Heptachlor	97	34 - 111	1.
4,4'-DDD	79	31 - 141	6.
4,4'-DDE	117	30 - 145	0.4
4,4'-DDT	90	25 - 160	5.9
Dieldrin	86	36 - 146	2.9
Endosulfan I	76	45 - 153	4.5
Endosulfan II	40	1 - 202	18.1
Endosulfan sulfate	124	26 - 144	1.6
Endrin	81	30 - 147	5.
Heptachlor epoxide	91	37 - 142	1.6
Lindane (gamma-BHC)	84	32 - 127	2.4

QUALITY CONTROL DATA:

Surrogate	Percent Recovery	Acceptable Range
Decachlorobiphenyl	100	70 - 130
Tetrachloro-m-xylene	82	70 - 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Laboratory Control Spike**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	L9708036-LCS
TEST:	**Metals**		
MATRIX:	Aqueous	ANALYST:	JL
		EXTRACTED:	8/11/97
		ANALYZED:	8/11/97

PARAMETER	Percent Recovery	Acceptable Range
Aluminum	89	85 - 115
Antimony	86	85 - 115
Arsenic	98	85 - 115
Barium	97	85 - 115
Beryllium	100	85 - 115
Cadmium	100	85 - 115
Calcium	105	85 - 115
Chromium	102	85 - 115
Copper	100	85 - 115
Iron	100	85 - 115
Lead	100	85 - 115
Magnesium	100	85 - 115
Manganese	102	85 - 115
Nickel	103	85 - 115
Potassium	95	85 - 115
Selenium	100	85 - 115
Silver	90	85 - 115
Sodium	119	85 - 115
Thallium	92	85 - 115
Zinc	100	85 - 115

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Matrix Spike**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	L9708036-01-MS
TEST:	**Metals**		
MATRIX:	Aqueous	ANALYST:	JL
		EXTRACTED:	8/11/97
		ANALYZED:	8/11/97

PARAMETER	Percent Recovery	Acceptable Range
Aluminum	111	85 - 115
Antimony	86	85 - 115
Arsenic	98	85 - 115
Barium	95	85 - 115
Beryllium	100	85 - 115
Cadmium	105	85 - 115
Calcium	60	85 - 115
Chromium	100	85 - 115
Copper	99	85 - 115
Iron	98	85 - 115
Lead	100	85 - 115
Magnesium	90	85 - 115
Manganese	96	85 - 115
Nickel	101	85 - 115
Potassium	83	85 - 115
Selenium	100	85 - 115
Silver	94	85 - 115
Sodium	85	85 - 115
Thallium	81	85 - 115
Zinc	112	85 - 115

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	CLIENT ID:	**Matrix Spike Duplicate**
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
PROJECT #:	NA	NEL SAMPLE ID:	L9708036-01-MSD
TEST:	**Metals**		
MATRIX:	Aqueous	ANALYST:	JL
		EXTRACTED:	8/11/97
		ANALYZED:	8/11/97

PARAMETER	Percent Recovery	Acceptable Range	RPD
Aluminum	107	85 - 115	3.7
Antimony	94	85 - 115	8.9
Arsenic	106	85 - 115	7.8
Barium	109	85 - 115	13.7
Beryllium	110	85 - 115	9.5
Cadmium	115	85 - 115	9.1
Calcium	120	85 - 115	66.7
Chromium	108	85 - 115	7.7
Copper	107	85 - 115	7.8
Iron	106	85 - 115	7.8
Lead	109	85 - 115	8.6
Magnesium	125	85 - 115	32.6
Manganese	110	85 - 115	13.6
Nickel	110	85 - 115	8.5
Potassium	93	85 - 115	11.4
Selenium	108	85 - 115	7.7
Silver	106	85 - 115	12.
Sodium	120	85 - 115	34.1
Thallium	83	85 - 115	2.4
Zinc	106	85 - 115	5.5

ND - Not Detected

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CTS

Analytical Report

Client: NEL Laboratories
Project: Kimley Horn: MCFCD
Sample Matrix: Water

Date/Time Received: 08-03-97 / 10:11
Purchase Order No.: None given

Coliform, Fecal (MPN)
SM 18-9221 B & C
MPN Index/100 ml

Sample I.D.	Lab I.D.	Date/Time Started	Date/Time Completed	Result
Location #5-1	9700120	08-03-97 / 10:28	08-05-97 / 12:23	≥1600
Location #6-1	9700121	08-03-97 / 10:38	08-05-97 / 12:32	≥1600

Reviewed by: [signature] Date: August 6, 1997

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CHAIN OF CUSTODY

Phoenix Division • 3021 S. 35th St., Bldg. B, Suite 6 • Phoenix, AZ 85034
(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kimley-Horn : MCFCD
Project No.:
P.O. No.:
Sampled By: Robert Forsberg

Company: Kimley-Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, #250 Phoenix, AZ 85020
Phone No.: (602) 944-5500
Fax No.: (602) 944-7423
Billing Address: same
Expected Due Date: 8/13

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	EPA 624	EPA 625/608	Oil & Grease; TSS; P.P. Metals	Cl^-, SO_4, NO_2, ~~NO_3~~, phosphate	COD					pH (for lab use only)	Remarks
8/3/97 9:00	Location #5-1	P9708007-01	12	Aq		U	✓	✓	✓	✓	✓						
8/3/97 7:55	Location #6-1	-02	12	Aq		U	✓	✓	✓	✓	✓						
4/4/97 15:00	~~Trip Blank~~ Travel Blank	-03	2	Aq		L	✓										Headspace in 1 VOA

Custody Seal intact? (Y) N None Temp. 10°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

	Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1	Robert Forsberg	Robert Forsberg	8/4/97 14:45	FEDEX		
2		FEDEX		Mike Eng		8/6/97 1050
3						
4						

This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents

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Reno • Las Vegas
Phoenix • Burbank

Las Vegas Division
4208 Arcata Way, Suite A • Las Vegas, NV 89030
(702) 657-1010 • Fax: (702) 657-1577
1-888-368-3282

FACSIMILE TRANSMISSION

TO: Bruce Wilcox

COMPANY: Kimley Horn

PHONE:

FAX: 602944 7423

FROM: Michael

DATE: 4/4/97

NO. OF PAGES: 2
(including cover page)

☐ *Hard copy will follow* ☐ *Hard copy will not follow*

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Phoenix Division • 3021 S. 35th St., Bldg. B, Suite 6 • Phoenix, AZ 85034
(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kimley Horn : MCFCD
Project No.: C601-97-014-S
P.O. No.:
Sampled By: Robert Forsberg

Company: Kimley Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, Suite 250 Phoenix, AZ 85020
Phone No.: 602/944-5500
Fax No.: 602/944-7423
Billing Address: same
Expected Due Date: 4/10/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: TSS : oil : grease								pH (for lab use only)	Remarks
4/3/97 8:05	location #4-2	9704100 2-01	3	AQ	E	U	X									2 bottles for oil & grease for breakage
9:30	3-2	02	↓	↓	↓	↓	X									
10:20	1-2	03	↓	↓	↓	↓	X									

Custody Seal intact (Y) N None Temp. 2°
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Carolina Mora	Carolina Mora	4/3/97 16:00	UPS		
2 UPS			Mike Espy	[signature]	4/4/97 1025
3					
4					

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Phoenix • Burbank

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: Your samples were received in Reno in good condition.

FROM: Dolly

PAGE 1 of 3

DATE: 4/3/97

TIME:

NEL LABORATORIES

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CHAIN OF CUSTODY

Phoenix Division • 3021 S. 35th St., Bldg. B, Suite 6 • Phoenix, AZ 85034
(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kimley-Horn: MCFCD
Project No.:
P.O. No.:
Sampled By: Robert Forsberg

Company: Kimley-Horn Attn.: Bruce Wilcox
Address: 7600 N. 15th Street #250
Phoenix, AZ 85020
Phone No.: (602) 944-5500 Fax No.: (602) 944-7423
Billing Address: Same Expected Due Date:

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Oil & Grease	TDS	TSS	P.P. Metals	COD	pH (for lab use only)	Remarks
4/2/97 8:00	Location #4-1	P9904001 - 01	5	Aq		U	✓	✓	✓	✓			
4/2/97 8:40	Location #1-1	↓ 02	5	Aq		U	✓	✓	✓	✓			
4/2/97 9:15	Location #3-1	↓ 03	5	Aq		U	✓	✓	✓	✓			

Custody Seal intact? (Y) N None Temp. 8°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Robert Forsberg	Robert Forsberg	4/2/97 11:20	Carolina Mora	Carolina Mora	4/2/97 11:20
2					
3					
4					

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(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kimley-Horn ; MCFCD
Project No.: C69-97-014-5
P.O. No.:
Sampled By: Robert Forsberg

Company: Kimley Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, Suite 250 Phoenix, AZ 85020
Phone No.: 602/944-5500
Fax No.: 602/944-7423
Billing Address: same
Expected Due Date: 4/9/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: 7 P. Metals (13)									pH (for lab use only)	Remarks
4/2/97 8:00	Location #4-1	PG704001-01	1	AQ	B	U	X										
8:40	1-1	02	1	↓	↓	↓	X										
9:15	3-1	03	1	↓	↓	↓	X										

Custody Seal intact? (Y) N None Temp. 4°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Carolina Mora	Carolina Mora	4/2/97 16:00	UPS -	—	
2 UPS from Phoenix via UPS	—		Dolly S. Thomsen	Dolly S. Thomsen	4/3/97 1135am
3					
4					

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1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: We received your samples in Reno in good condition.

FROM: Dolly

PAGE 1 of 3

DATE: 4/4/97

TIME:

NEL LABORATORIES

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CHAIN OF CUSTODY

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Project Name: Kimley-Horn : MCFCD
Project No.:
P.O. No.:
Sampled By: Robert Forsberg

Company: Kimley-Horn
Attn.: Bruce Wilcox
Address: 7000 N. 15th Street, #250
Phoenix, AZ 85020
Phone No.: (602) 944-5500
Fax No.: (602) 944-7423
Billing Address: Same
Expected Due Date: 4/10/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Oil & grease	TSS	COD	P.P. Metals	pH (for lab use only)	Remarks
4/3/97 8:05	Location #4-2	P9704002-01	5	AQ		U	✓	✓	✓	✓		
4/3/97 9:30	Location #3-2	02	5	AQ		U	✓	✓	✓	✓		
4/3/97 10:20	Location #1-2	03	5	AQ		U	✓	✓	✓	✓		

Custody Seal intact? (Y) N None Temp. 8°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

	Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1	Robert Forsberg	Robert Forsberg	4/3/97 11:50	Carolina Mora	Carolina Mora	4/3/97 11:50
2						
3						
4						

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Project Name: Kimley Horn; MCFCD
Project No.: C69-97-014-5
P.O. No.:
Sampled By: Robert Furs[illegible]

Company: Kimley Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, Suite 250 Phoenix, AZ 85020
Phone No.: 602/944-5500
Fax No.: 602/944-7423
Billing Address: Same
Expected Due Date: 4/10/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Analysis: P.P. Metals (13); pH (for lab use only)

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	P.P. Metals (13)	pH (for lab use only)	Remarks
4/3/97 8:05	Location #4-2	P9704002-01	1	AQ	B	U	X		
9:30	3-2	02	↓	↓	↓	↓	X		
10:20	1-2	03	↓	↓	↓	↓	X		

Custody Seal intact? (Y) N None Temp. 2°C
Condition when received (good)

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Carolina Mora	Carolina Mora	4/3/97 16:00	UPS —	—	
2 UPS from Phoenix via	UPS —		Dolly S. Thomsen	Dolly S. Thomsen	9:44am 4/4/97
3					
4					

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1-888-368-3282

FACSIMILE TRANSMISSION

TO: Bruce Wilcox

COMPANY: Kimley Horn

PHONE: 602 944 5500

FAX: 602 944 7423

FROM: Michael

DATE: 4/3/97

NO. OF PAGES: 2
(including cover page)

☐ *Hard copy will follow* ☐ *Hard copy will not follow*

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CHAIN OF CUSTODY

Project Name: Kinley-Horn: MCFCD
Project No.: C69-97-014-5
P.O. No.:
Sampled By:

Company: Kinley Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, Suite 250 Phoenix, AZ 85020
Phone No.: 602/944-5500
Fax No.: 602/944-7423
Billing Address: same
Expected Due Date: 4/9/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: Oil & Grease	Analysis: TPH	pH (for lab use only)	Remarks
4/2/97 8:00	Location #4-1	P9704001-01	3	AQ	HCl	U	X	X		2 oil & grease bottles due to breakage
8:40	1-1	02	3			U	X	X		
9:15	3-1	03	3			U	X	X		

MC 4-3-97

Custody Seal intact? (Y) N None Temp. 10°
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Carolina Mora	Carolina Mora	4/2/97 16:00	UPS		
2 UPS	Rec'd via UPS		T. Smallwood	[signature]	4-3-97 / 0955
3					
4					

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FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

ADDRESS:

PHONE #:

FAX #: 602 944 7423

MESSAGE: Samples received in L.V. in good condition. Change was made from TDS to TSS for 3 samples.

FROM: Michael

PAGE 1 OF: 4

DATE: 2/27/97

TIME: 10:00

NEL LABORATORIES

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CHAIN OF CUSTODY

Project Name: KIMLEY-HORN ; MCFCD
Project No.: C-69-97-014-5
P.O. No.:
Sampled By: BOB FORSBURG

Company: Kimley-Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, Suite 250, Phoenix, AZ 85020
Phone No.: 602/944-5500
Fax No.: 602-944-7423
Billing Address:
Expected Due Date: 3/5/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: Cl, fluoride	Analysis: ~~TDS~~ TSS	Analysis	Analysis	Analysis	Analysis	Analysis	Analysis	Analysis	pH (for lab use only)	Remarks
2/25/97 16:30	~~P97~~ CMS LOCATION #4-OG-A	P97-02006-01	1	AQ	C	L	✓										
2/25/97 16:30	LOCATION #4-OG-B-1	P97-02006-01	1	AQ	C	L	✓										duplicate/do not run
2/25/97 16:30	LOCATION #4-TDS-1	P97-02006-01	1	AQ	C	L		✓									
2/25/97 17:05	LOCATION #3-OG-A-1	P97-02006-02	1	AQ	C	L	✓										
2/25/97 17:05	LOCATION #3-OG-B-1	P97-02006-02	1	AQ	C	L	✓										duplicate do not run
2/25/97 17:05	LOCATION #3-TDS-1	P97-02006-02	1	AQ	C	L		✓									
2/25/97 18:30	LOCATION #4-OG-A-2	P97-02006-03	1	AQ	C	L	✓										
2/25/97 18:30	LOCATION #4-OG-B-2	P97-02006-03	1	AQ	C	L	✓										duplicate DO NOT RUN
2/25/97 18:30	LOCATION #4-TDS-2	P97-02006-03	1	AQ	C	L		✓									

Custody Seal intact? ~~Yes~~ N None Temp. 2°
Condition when received Good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 ~~Christina Moon~~	~~Christina Moon~~ SP		~~UPS~~ SP		
2 SANDRA FAIRBANKS	Sandra Fairbanks	2/25/97 15:00	to NEL Las Vegas via UPS		2/26/97 15:00
3 UPS			Mike Espey		2/27/97 9:42
4					

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NEL COOLER RECEIPT FORM

NEL Work Order ID : P9702006

Received by (Sign): Michael [illegible]

Received by (Print Name): Michael

Date Received: 2/27/97 Time Receive: 9:48

Received Via: ☑ UPS ☐ Fed Ex ☐ US Mail ☐ Other

Sample Temperature (Deg C): _____

Custody Seals on ALL coolers: ☑ Yes ☐ No All seals intact: ☐ Yes ☐ No

Seal date: 2/27/97 Seal Name: Sandra Fairbank

WRONG DATE should be 2/26/97

Custody Seals on ALL samples: ☐ Yes ☑ No All seals intact: ☐ Yes ☐ No NA

Chain of Custody Present: ☑ Yes ☐ No COC agrees with samples received ☐ Yes ☑ No

If COC and samples do not match please explain: WRONG ANALYSES ON COC. TDS should be TSS. CHANGE ORDER FORM SENT FROM Phoenix

ALL samples preserved correctly: ☑ Yes ☐ No

If no, please explain: _____

ALL samples received in good condition: ☑ Yes ☐ No

If no, please explain: _____

Enough sample for ALL requested analysis: ☑ Yes ☐ No

ALL samples requiring no headspace are free of headspace: ☐ Yes ☐ No NA

Date Cooler Receipt Form reviewed by Project Manager: _____

Comments:

NEL LABORATORIES

CHAIN OF CUSTODY CHANGE ORDER FORM

Date: 2/27/97 Change Requested by: Carolina Mora-Stangis

NEL Order ID: P9702006

Name of Client/Contact: Bruce Wilcox - Kimley Horn

Date Client Contacted: —

Analysis Added: TDS

Analysis Deleted: TDS

Samples Added:

Samples Deleted:

Reason for Change: Written wrong on COC.

Is there sufficient sample for analysis/samples added? Yes No

Are the samples properly preserved for analysis/sample added? Yes No

Can the samples be analyzed within hold time? Yes No

Expected Due Date: 3/5/97

Change form faxed to: Burbank Las Vegas Phoenix Reno

Date and time faxed: 9:13 am 2/27/97

NEL contact person: Carolina

Signed: Carolina Mora-Stangis

CHNGORDR.DOC

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1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: We received your samples in NEL-Reno in good condition. Thank You.

FROM: Dolly

PAGE 1 of 4

DATE: 2/27/97

TIME:

NEL LABORATORIES

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(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

CHAIN OF CUSTODY

Project Name: Kimley-Horn: MCFD
Project No.:
P.O. No.:
Sampled By: Bob Forsberg

Company: ~~NEL~~ Kimley-Horn
Attn.: ~~Eileen Ferguson~~ Bruce Wilcox
Address: ~~1030 Matley Lane~~ ~~Reno, NV 89502~~ 7600 N. 15th St. #250 Phoenix, AZ 85020
Phone No.: ~~(702) 348-2522~~
Fax No.: ~~(702) 348-2546~~
Billing Address: 602-944-5500 same
Expected Due Date: (602) 944-7423 3/5/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	624	625/608	Oil & Grease, TDS, P.P. Metals (13), Cn-, SO4, NO3, NO2, phosphate	COD	pH (for lab use only)	Remarks
2/25/97 18:30	Location #4-OG-A-2	897-02006-03	1	Aq	C	U		X				
2/25/97 18:30	Location #4-OG-B-2	↓	1	Aq	C	U		X				
2/25/97 18:30	Location #4-COD-2	↓	1	Aq	C	U			X			
2/25/97 18:30	Location #4-PPM-2	↓	1	Aq	B	U		X				
2/25/97 18:30	Location #4-TDS-2	↓	1	Aq	G	U		X				
1/30/97	Trip Blank-1		1	Aq	A	L	X					

Custody Seal intact? (Y) N None Temp. 4°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Robert Forsberg	Robert Forsberg	2/26/97 07:50	Sandra Fairbanks	Sandra Fairbanks	2/26/97 7:50AM
2					
3					
4					

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Project Name: KIMLEY-HORN : MCFCD
Project No.: C69-97-014-5
P.O. No.:
Sampled By: BOB FORSBERG

Company: Kimley Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street Suite 250
Phoenix, AZ 85020
Phone No.: 602/944 5500
Fax No.: 602/944-7423
Billing Address: SAME
Expected Due Date: 3/5/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: PP METALS	pH (for lab use only)	Remarks
2/25/97 16:30	~~P97~~ CMS LOCATION #4 - PPM-1	P97-02006-01	1	AQ	B		X		
2/25/97 17:05	LOCATION #3 - PPM-1	P97-02006-02	1	AQ	B		X		
2/25/97 18:30	LOCATION #4 - PPM-2	P97-02006-03	1	AQ	B		X		

Custody Seal intact? (Y) N None Temp. 4°C
Condition when received (good)

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 ~~Carolina Mena~~	~~Carolina Mena~~		~~OPS~~ SF		
2 Sandra FAIRBANKS	Sandra Fairbanks		to NEL Reno	via UPS	2/26/97 15:00
3 from Phoenix via UPS			Dolly S. Thomsen	Dolly S. Thomsen	2/27/97 9:36am
4					

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1-888-368-3282

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley Horn

ADDRESS:

PHONE #:

FAX #: 602 944 7423

MESSAGE: Samples Received in good condition on 3/1/97.

FROM: Michael

PAGE 1 OF: ~~2~~ 3

DATE: 3/3/97

TIME: 1030

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(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kinley-Horn ; MCCCD
Project No.: C69-97-014-5
P.O. No.:
Sampled By:

Company: Kinley Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, Suite 250 Phoenix, AZ 85020
Phone No.: 602/944-5500
Fax No.: 602/944-7423
Billing Address: same
Expected Due Date: 3/7/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: oil; Grease; TSS	Analysis: Cr; SO4; NO2; NO3; phosphate	Analysis: pH (for lab use only)	Remarks
2/27/97 22:40	Location #2 (2)	PC9702008 -01	3	AQ	E/P		X			② 0.5 bottles for lab purpose
2/27/97 18:00	Location #3 (2)	-02	↓	↓	↓		X			
2/27/97 14:45	Location #2 (1)	-03	↓	↓	↓		X			
2/27/97 15:50	Location #1 (1)	-04	6	↓	E/P		X	X		
2/27/97 18:40	Location #1 (2)	-05	6	↓	↓		X	X		

Custody Seal intact? Y N None Temp. 5°
Condition when received (good)

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Carolyn Morris	Carolyn Morris	2/28/97 15:00	UPS	—	
2 UPS			Suzanne R. Pyle	Suzanne R Pyle	3/1/97 10:30 AM
3					
4					

This report is applicable only to the sample received by the laboratory. The liability of the laboratory is limited to the amount paid for this report. This report is for the exclusive use of the client to whom it is addressed and upon the condition that the client assumes all liability for the further distribution of the report or its contents.

NEL COOLER RECEIPT FORM

NEL Work Order ID : P9702008

Received by (Sign): Suzanne Pyle

Received by (Print Name): Suzanne Pyle

Date Received: 3-1-97 Time Receive: 10:30AM

Received Via: ☒ UPS
☐ Fed Ex
☐ US Mail
☐ Other

Sample Temperature (Deg C): 6 °

Custody Seals on ALL coolers: ☒ Yes ☐ No All seals intact: ☒ Yes ☐ No

Seal date: 2-28-97 Seal Name: Carolina

Custody Seals on ALL samples: ☐ Yes ☒ No All seals intact: ☐ Yes ☒ No

Chain of Custody Present: ☒ Yes ☐ No COC agrees with samples received ☒ Yes ☐ No

If COC and samples do not match please explain: NA

ALL samples preserved correctly: ☒ Yes ☐ No

If no, please explain: NA

ALL samples received in good condition: ☒ Yes ☐ No

If no, please explain: NA

Enough sample for ALL requested analysis: ☒ Yes ☐ No

ALL samples requiring no headspace are free of headspace: ☐ Yes ☐ No NA

Date Cooler Receipt Form reviewed by Project Manager: _____

Comments:

NEL LABORATORIES
Reno • Las Vegas • Phoenix

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: We received your samples at NEL-Reno in good condition.
Thank You

FROM: Dolly

PAGE 1 of 6

DATE: 3/4/97

TIME:

NEL LABORATORIES

Reno • Las Vegas • Phoenix

CHAIN OF CUSTODY

Phoenix Division • 3021 S. 35th St., Bldg. B, Suite 6 • Phoenix, AZ 85034
(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kinley Horn ; MCFCD
Project No.: C69-97-014
P.O. No.:
Sampled By:

Company: Kinley Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, Suite 250 Phoenix, AZ
Phone No.: 602/944-5500
Fax No.: 602/944-7423
Billing Address: same
Expected Due Date: 3/7/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: P.P. metals (13)	Analysis: 624, 625, 608 Pesticides	Analysis: 624	Analysis: pH (for lab use only)	Remarks
2/27/97 2240	Location #2-PPM-2	P9702008-01	1	AQ	B	U	X				
2/27/97 18:00	Location #3-PPM-2	-02	1		B		X				
2/27/97 19:45	Location #2-PPM-1	-03	1		B		X				
2/27/97 15:50	Location #1 (1)	-04	6		B,A		X	X			
2/27/97 18:40	Location 1 (2)	-05	6		↓		X	X			
1/30/97	Travel Blk (NEL)	-06	2	✓	A				X		

Custody Seal intact? Y N None Temp. ____
Condition when received good

Box #1		Box #2		Box #3
DW - Drinking Water	SO - Soil	A. HCl	E. Ice Only	H - High
WW - Waste Water	SD - Solid	B. HNO_3	F. Other ____	M - Medium
RW - RCRA Water	AQ - Aqueous	C. H_2SO_4	G. Not Preserved	L - Low
OL - Oil	A - Air	D. NaOH		U - Unknown
SG - Sludge				

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Carolina Mora	Carolina Mora	3/3/97 15:00	UPS -	—	
2 from NEL - Phoenix via UPS			Dolly S. Thomsen	Dolly S. Thomsen	3/4/97 9:10am
3					
4					

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NEL LABORATORIES

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CHAIN OF CUSTODY

Phoenix Division • 3021 S. 35th St., Bldg. B, Suite 6 • Phoenix, AZ 85034
(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kimley-Horn ; MCFCD
Project No.:
P.O. No.:
Sampled By: R. Forsberg

Company: Kimley-Horn Attn.: Bruce Wilcox
Address: 7600 N. 15th Street #250
Phoenix AZ 85020
Phone No.: (602) 944-5500 Fax No.: (602) 944-7423
Billing Address:
Expected Due Date: 3/7/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	624	625/608	oil & grease	Cr-VI	COD	TDS	TSS	pH	P.P. metals (7)	SO4, NO3, NO2, phosphate	pH (for lab use only)	Remarks
2/27/97 22:40	Location #2-TDS-2	P9702008-01	1	AQ	G	U			X									
2/27/97 22:40	Location #2-COD-2		1	AQ	C	U					X							
2/27/97 22:40	Location #2-PAH-2		1	AQ	B	U			X									
2/27/97 22:40	Location #2-OG-2		2	AQ	C	U			X									

Custody Seal intact? (Y) N None Temp. 3°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

	Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1	Robert Forsberg	Robert Forsberg	2/28/97 8:50	Carolina Mora	Carolina Mora	2/28/97 8:50
2						
3						
4						

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(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kimley-Horn: MCFCD
Project No.:
P.O. No.:
Sampled By: R. Forsberg

Company: Kimley-Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street, #250
Phoenix, AZ 85020
Phone No.: (602) 944-5500
Fax No.: (602) 944-7423
Billing Address: Same
Expected Due Date: 3/7/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	624	625/608	oil & grease	TDS	P.P. Metals (3)	Cr, SO4, NO3, NO2, phosphate	COD	pH (for lab use only)	Remarks
2/27/97 18:00	Location #3-PPM-2	P9702008-02	1	AQ	B	U		X							
2/27/97 18:00	Location #3-OG-2		2	AQ	C	U		X							
2/27/97 18:00	Location #3-TDS-2		1	AQ	G	U		X							
2/27/97 18:00	Location #3-COD-2		1	AQ	C	U				X					
2/27/97 19:45	Location #2-PPM-1	P9702008-03	1	AQ	B	U		X							
2/27/97 19:45	Location #2-OG-1		2	AQ	C	U		X							
2/27/97 19:45	Location #2-TDS-1		1	AQ	G	U		X							
2/27/97 19:45	Location #2-COD-1		1	AQ	C	U				X					
~~2/27/97 22:40~~	~~Location #2-PPM-2~~ REF	REF	~~1~~	~~AQ~~	~~B~~	~~U~~		~~X~~	REF						
~~2/27/97 22:40~~	~~Location #2-OG-2~~ REF	REF	~~2~~	~~AQ~~	~~C~~	~~U~~		~~X~~	REF						

Custody Seal intact? (Y) N None Temp. 3°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

	Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1	Robert Forsberg	Robert Forsberg	2/28/97 8:50	Cameron Moran	Cameron Moran	2/28/97 8:50
2						
3						
4						

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NEL LABORATORIES

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(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

CHAIN OF CUSTODY

Project Name: Kinley Horn & MCFCD
Project No.:
P.O. No.:
Sampled By: Robert Forsberg

Company: Kinley-Horn Attn.: Bruce Wilcox
Address: 7600 N 15th Street, #250 Phoenix, AZ 85020
Phone No.: (602) 944-5500 Fax No.: (602) 944-7423
Billing Address: same Expected Due Date: 3/7/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	Analysis: 624	625/608	oil & grease	TSS	TDS	PP Metals	Cr	SO_4	NO_2	NO_3	phosphate	COD	pH (for lab use only)	Remarks
2/27/97 15:50	Location #1-1		2	AQ	A	U	X													
2/27/97 1/3/97	Travel Blank-2 →	P9702008-00	2	AQ	A	L	X													
2/27/97 15:50	Location #1-1A		3	AQ	G	U		X												
2/27/97 15:50	Location #1-OG-1	P9702008-04	2	AQ	C	U			X											
2/27/97 15:50	Location #1-COD-1		1	AQ	C	U							X							
2/27/97 15:50	Location #1-TDS-1		1	AQ	G	U			X											
2/27/97 15:50	Location #1-Ph-1		1	AQ	C	U				X										
2/27/97 15:50	Location #1-C-1		1	AQ	D	U				X										
2/27/97 15:50	Location #1-SNN-1		1	AQ	G	U				X										
2/27/97 15:50	Location #1-PPM-1		1	AQ	B	U			X											

Custody Seal intact? (Y) N None Temp. 6°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Robert Forsberg	Robert Forsberg	2/28/97 8:50	Carolina Mora	Carolina Mora	2/28/97 8:30
2					
3					
4					

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NEL LABORATORIES

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CHAIN OF CUSTODY

2/2

Phoenix Division • 3021 S. 35th St., Bldg. B, Suite 6 • Phoenix, AZ 85034
(602) 437-0099 • Fax: (602) 437-2225 • 1-800-368-5221

Project Name: Kimley-Horn: MCFCD
Project No.:
P.O. No.:
Sampled By: Bob Forsberg

Company: Kimley-Horn
Attn.: Bruce Wilcox
Address: 7600 N. 15th Street #250, Phoenix, AZ 85020
Phone No.: (602) 944-5500
Fax No.: (602) 944-7423
Billing Address: Same
Expected Due Date: 3/7/97

Requested Turnaround: ✓ 5 Day (Normal) ____ 48 Hr. ____ 24 Hr. ____ Other

Sample Date/Time	Sample ID	N.E.L. Identification	# of Containers	Matrix (Box #1)	Preservative (Box #2)	Expected Concentration (Box #3)	6024	6025/6008	oil & grease	Cn, SO4, NO2, NO3, phosphate	COD	TDS	P.P. metals (13)	pH (for lab use only)	Remarks
2/27/97 18:40	Location #1-2		2	AQ	A	U	X								
2/27/97 18:40	Location #1-2A		3	AQ	G	U		X							
2/27/97 18:40	Location #1-Ph-2		1	AQ	C	U			X						
2/27/97 18:40	Location #1-COD-2		1	AQ	C	U				X					
2/27/97 18:40	Location #1-OG-2	9702008-05	2	AQ	C	U			X						
2/27/97 18:40	Location #1-SNN-2		1	AQ	G	U				X					
2/27/97 18:40	Location #1-C-2		1	AQ	D	U				X					
2/27/97 18:40	Location #1-TDS-2		1	AQ	G	U			X						
2/27/97 18:40	Location #1-PPM-2		1	AQ	B	U			X						

Custody Seal intact? (Y) N None Temp. 6°C
Condition when received good

Box #1: DW - Drinking Water; WW - Waste Water; RW - RCRA Water; OL - Oil; SG - Sludge; SO - Soil; SD - Solid; AQ - Aqueous; A - Air

Box #2: A. HCl; B. HNO_3; C. H_2SO_4; D. NaOH; E. Ice Only; F. Other ____; G. Not Preserved

Box #3: H - High; M - Medium; L - Low; U - Unknown

Relinquished by (Print)	(Signature)	Date/Time	Received by (Print)	(Signature)	Date/Time
1 Robert Forsberg	Robert Forsberg	2/28/97 8:50	Carolina Mora	Carolina Mora	2/28/97 8:50
2					
3					
4					

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NEL LABORATORIES
Reno • Las Vegas
Phoenix • Burbank

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: COD results for projects P9702006 & P9702008

FROM: Dolly

PAGE 1 of 3

DATE: 3/21/97

TIME:

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

NEL Laboratories
1030 Matley Lane
Reno, NV 89502
Eileen Ferguson

Client Project ID: *C69-97-014-5*
ACZ Report ID: *RG40406*
Date Reported: *3/17/97*
Sample Matrix: *Surface Water*

Wet Chemistry — **Chemical Oxygen Demand** — **M410.4**

Lab Sample ID	Client Sample ID	Sample Date	Receive Date	Result	Qual	Units	MDL	PQL	Date	Analyst
L12838-01	Loc #4-COD-1	2/25/97	2/27/97	50	B	mg/L	10	50	3/11/97	jk
L12838-02	Loc #3-COD-1	2/25/97	2/27/97	40	B	mg/L	10	50	3/11/97	jk
L12838-03	Loc #4-COD-2	2/25/97	2/27/97		U	mg/L	10	50	3/11/97	jk

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL
B = Analyte concentration detected at a value between MDL and PQL
PQL = Practical Quantitation Limit

Ralph V. Poulsen
Vice President of Operations: Ralph Poulsen

ACZ

Analytical Results

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493

NEL Laboratories
1030 Matley Lane
Reno, NV 89502
Eileen Ferguson

Client Project ID: *C69-97-014-5*
ACZ Report ID: *RG40521*
Date Reported: *3/17/97*
Sample Matrix: *Surface Water*

Wet Chemistry — **Chemical Oxygen Demand** — **M410.4**

Lab Sample ID	Client Sample ID	Sample Date	Receive Date	Result	Qual	Units	MDL	PQL	Date	Analyst
L12869-01	Loc#2-COD-2	2/27/97	3/1/97	40	B	mg/L	10	50	3/11/97	jk
L12869-02	Loc#3-COD-2	2/27/97	3/1/97	50		mg/L	10	50	3/11/97	jk
L12869-03	Loc#2-COD-1	2/27/97	3/1/97	60		mg/L	10	50	3/11/97	jk
L12869-04	Loc#1-COD-1	2/27/97	3/1/97	230	B	mg/L	50	300	3/11/97	jk
L12869-05	Loc#1-COD-2	2/27/97	3/1/97	30	B	mg/L	10	50	3/11/97	jk

Inorganic Qualifiers (based on EPA CLP 3/90)

U = Analyte was analyzed for but not detected at the indicated MDL

B = Analyte concentration detected at a value between MDL and PQL

PQL = Practical Quantitation Limit

Ralph V. Poulsen

Vice President of Operations: Ralph Poulsen

NEL LABORATORIES
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Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcoy

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: Report # P9702006
Kimley-Horn: MCFCD

also included is fax from CTS for Fecal Coliform, COD results pending.

FROM: Dolly

PAGE 1 of 11

DATE: 3/5/97

TIME:

CTS

ANALYTICAL REPORT

Client:	NEL Laboratories	Date Received:	02/25/97
Project:	None	Date Analyzed:	02/25/97
Sample Matrix:	Water	P. O. Number:	None

Coliform, Fecal (MPN)
SM 18-9221 B & C
MPN Index/100 ml

Sample Name	Laboratory I.D. No.	Result
Location #4-FC-1	9700048	900
Location #4-FC-1	9700049	30
Location #4-FC-2	9700050	900

Approved by: [signature] Date: 2-28-97

NEL LABORATORIES
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Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Kimley-Horn
7600 N. 15th St. #250
Phoenix, AZ 85020

ATTN: Bruce Wilcox

PROJECT NAME: Kimley-Horn: MCFCD NEL ORDER ID: P9702006

Attached are the analytical results for samples in support of the above referenced project.

Samples submitted for this project were not sampled by NEL Laboratories. Samples were received by NEL in good condition, under chain of custody on 2/26/97 .

Samples were analyzed as received.

Where applicable we have included the following quality control data:

Method blank - used to demonstrate absence of contamination or interferences in the Analytical process.
Laboratory Control Spike (LCS) - used to demonstrate laboratory ability to perform the method within specifications by spiking representative analytes into a clean matrix.
Surrogates - compounds added to each sample to ensure that the method requirements are met for each individual sample.

Should you have any questions or comments, please feel free to contact our Client Services department at (602) 437-0099 .

Inorganic analysis performed at NEL Las Vegas.

Eileen M. Ferguson
Laboratory Manager

Date

CERTIFICATIONS:

	Reno	Las Vegas
Arizona	AZ0520	AZ0518
California	1707	2002
US Army Corps of Engineers		

	Reno	Las Vegas
Idaho	Certified	Certified
Nevada	NV033	NV052
Montana	Certified	Certified

NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-1**

NEL ORDER ID: P9702006
DATE SAMPLED: 2/25/97
NEL SAMPLE ID: P9702006-01

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Copper	ND	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/4/97	3/4/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/4/97	3/4/97
Zinc	0.012	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97

D.F. - Dilution Factor

ND - Not Detected

This report shall not be reproduced except in full, without the written approval of the laboratory.

NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #3-1**

NEL ORDER ID: P9702006
DATE SAMPLED: 2/25/97
NEL SAMPLE ID: P9702006-02

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Copper	0.030	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/4/97	3/4/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/4/97	3/4/97
Zinc	0.060	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-2**

NEL ORDER ID: P9702006
DATE SAMPLED: 2/25/97
NEL SAMPLE ID: P9702006-03

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Copper	ND	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/4/97	3/4/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/4/97	3/4/97
Zinc	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Method Blank**

NEL ORDER ID: P9702006
DATE SAMPLED: NA
NEL SAMPLE ID: P9702006H-BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/4/97	3/4/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Method Blank**

NEL ORDER ID: P9702006
DATE SAMPLED: NA
NEL SAMPLE ID: P9702006PI-BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97
Copper	ND	0.005 mg/L	1	EPA 6010A	3/4/97	3/4/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/4/97	3/4/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/4/97	3/4/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/4/97	3/4/97
Zinc	ND	0.01 mg/L	1	EPA 6010A	3/4/97	3/4/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-1**

NEL ORDER ID: P9702006
DATE SAMPLED: 2/25/97
NEL SAMPLE ID: P9702006-01

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	ND	1	1	EPA 413.1	mg/L	2/28/97
Total Suspended Solids	8.4	2	1	SM 2540 D	mg/L	2/28/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #3-1**

NEL ORDER ID: P9702006
DATE SAMPLED: 2/25/97
NEL SAMPLE ID: P9702006-02

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	ND	1	1	EPA 413.1	mg/L	2/28/97
Total Suspended Solids	2.4	2	1	SM 2540 D	mg/L	2/28/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-2**

NEL ORDER ID: P9702006
DATE SAMPLED: 2/25/97
NEL SAMPLE ID: P9702006-03

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	ND	1	1	EPA 413.1	mg/L	2/28/97
Total Suspended Solids	3.2	2	1	SM 2540 D	mg/L	2/28/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES
Reno • Las Vegas • Phoenix

Phoenix Division
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(602) 437-0099 • Fax: (602) 437-2225
1-800-368-5221

FACSIMILE TRANSMISSION

TO: Bruce

OF:

PHONE:

FAX:

FROM: Sandra

DATE:

NO. OF PAGES:
(including cover page)

☐ *Hard copy will follow* ☐ *Hard copy will **not** follow*

Corrected!

SAMPLING EVENT 1

FOR

KIMLEY HORN

PROJECT: STP - PAPAGO

Matix: Aqueous

	SAMPLING EVENT 1				
	FIRST FLUSH		AFTER 2 HOURS		
Site	**Sample Date**	**Time 1**	**Sample Date**	**Time 2**	**Comments**
Site 1	2/27/97	15:50	2/27/97	18:40	1 storm event
Site 2	2/27/97	19:45	2/27/97	22:40	1 storm event
Site 3	2/25/97	17:05	2/27/97	18:00	2 storm events: Sample 1 collected at first flush of 1st storm, Sample 2 collected after 2 hours of 2nd storm
Site 4	2/25/97	16:30	2/25/97	18:30	1 storm event

NEL LABORATORIES
Reno • Las Vegas • Phoenix

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

FACSIMILE TRANSMISSION

RECORDED 12 MARCH 97

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: Report # P9703008
MCFCD

Included is Coliform results from CTS. COD results pending.
Thank you.

FROM: Dorky

PAGE 1 of 25

DATE: 3/7/97

TIME:

NEL LABORATORIES
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Phoenix • Burbank

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Kimley-Horn
7600 N. 15th St. #250
Phoenix, AZ 85020

ATTN: Bruce Wilcox

PROJECT NAME: Kimley-Horn: MCFCD NEL ORDER ID: P9702008

Attached are the analytical results for samples in support of the above referenced project.

Samples submitted for this project were not sampled by NEL Laboratories. Samples were received by NEL in good condition, under chain of custody on 2/28/97 .

Samples were analyzed as received.

Where applicable we have included the following quality control data:

Method blank - used to demonstrate absence of contamination or interferences in the Analytical process.
Laboratory Control Spike (LCS) - used to demonstrate laboratory ability to perform the method within specifications by spiking representative analytes into a clean matrix.
Surrogates - compounds added to each sample to ensure that the method requirements are met for each individual sample.

Should you have any questions or comments, please feel free to contact our Client Services department at (602) 437-0099 .

For Method 608 one surrogate recovery must be within QC limits. This requirement was met in Location #1(2), but not in the duplicate analysis. For Method 625, Location#1(1) was analyzed at a 1:10 dilution. It will be reanalyzed without dilution.

Eileen M. Ferguson
Laboratory Manager

Date

CERTIFICATIONS:

	Reno	Las Vegas
Arizona	AZ0520	AZ0518
California	1707	2002
US Army Corps of Engineers		

	Reno	Las Vegas
Idaho	Certified	Certified
Nevada	NV033	NV052
Montana	Certified	Certified

NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	2/27/97
CLIENT ID:	**Location #1 (1)**	NEL SAMPLE ID:	P9702008-04

TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
METHOD:	EPA 608	ANALYST:	YW
MATRIX:	Aqueous	EXTRACTED:	3/4/97
DILUTION:	1	ANALYZED:	3/7/97

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	ND	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	ND	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Chlordane	ND	0.5 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Lindane (gamma-BHC)	ND	0.1 µg/L
Methoxychlor	ND	0.5 µg/L
Toxaphene	ND	2 µg/L
Arochlor-1016	ND	0.5 µg/L
Arochlor-1221	ND	0.5 µg/L
Arochlor-1232	ND	0.5 µg/L
Arochlor-1242	ND	0.5 µg/L
Arochlor-1248	ND	0.5 µg/L
Arochlor-1254	ND	0.5 µg/L
Arochlor-1260	ND	0.5 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	15	70 - 130
Tetrachloro-m-xylene	75	70 - 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	2/27/97
CLIENT ID:	**Location #1 (2)**	NEL SAMPLE ID:	P9702008-05

TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
METHOD:	EPA 608	ANALYST:	YW
MATRIX:	Aqueous	EXTRACTED:	3/4/97
DILUTION:	1	ANALYZED:	3/7/97

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	ND	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	ND	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Chlordane	ND	0.5 µg/L
4,4'-DDD	ND	0.1 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Lindane (gamma-BHC)	ND	0.1 µg/L
Methoxychlor	ND	0.5 µg/L
Toxaphene	ND	2 µg/L
Arochlor-1016	ND	0.5 µg/L
Arochlor-1221	ND	0.5 µg/L
Arochlor-1232	ND	0.5 µg/L
Arochlor-1242	ND	0.5 µg/L
Arochlor-1248	ND	0.5 µg/L
Arochlor-1254	ND	0.5 µg/L
Arochlor-1260	ND	0.5 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	12	70 - 130
Tetrachloro-m-xylene	72	70 - 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	2/27/97
CLIENT ID:	**Location #1 (1)**	NEL SAMPLE ID:	P9702008-04

TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
METHOD:	EPA 624	ANALYST:	JW
MATRIX:	Aqueous	EXTRACTED:	3/4/97
DILUTION:	1	ANALYZED:	3/4/97

PARAMETER	Result	Reporting Limit
Benzene	ND	2 µg/L
Bromodichloromethane	ND	5 µg/L
Bromoform	ND	5 µg/L
Bromomethane	ND	5 µg/L
Carbon tetrachloride	ND	5 µg/L
Chlorobenzene	ND	5 µg/L
Chloroethane	ND	5 µg/L
2-Chloroethylvinyl ether	ND	5 µg/L
Chloroform	ND	5 µg/L
Chloromethane	ND	5 µg/L
Dibromochloromethane	ND	5 µg/L
cis-1,2-Dichloroethene	ND	5 µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5 µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5 µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5 µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5 µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5 µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5 µg/L
trans-1,2-Dichloroethene	ND	5 µg/L
1,2-Dichloropropane	ND	5 µg/L
cis-1,3-Dichloropropene	ND	5 µg/L
trans-1,3-Dichloropropene	ND	5 µg/L
Ethylbenzene	ND	2 µg/L
Methylene chloride (Dichloromethane)	ND	5 µg/L
1,1,2,2-Tetrachloroethane	ND	5 µg/L
Tetrachloroethene (PCE)	ND	5 µg/L
Toluene	ND	2 µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5 µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5 µg/L
Trichloroethene (TCE)	ND	5 µg/L
Trichlorofluoromethane (Freon 11)	ND	5 µg/L
Vinyl chloride	ND	5 µg/L
m,p-Xylene	ND	2 µg/L
o-Xylene	ND	2 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	108	86- 115
Dibromofluoromethane	116	86- 118
Toluene-d8	110	88- 110

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
ROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	2/27/97
LIENT ID:	**Location #1 (2)**	NEL SAMPLE ID:	P9702008-05

TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
ETHOD:	EPA 624	ANALYST:	JW
ATRIX:	Aqueous	EXTRACTED:	3/4/97
DILUTION:	1	ANALYZED:	3/4/97

ARAMETER	Result	Reporting Limit
Benzene	ND	2 µg/L
Bromodichloromethane	ND	5 µg/L
romoform	ND	5 µg/L
romomethane	ND	5 µg/L
Carbon tetrachloride	ND	5 µg/L
hlorobenzene	ND	5 µg/L
hloroethane	ND	5 µg/L
2-Chloroethylvinyl ether	ND	5 µg/L
Chloroform	ND	5 µg/L
hloromethane	ND	5 µg/L
ibromochloromethane	ND	5 µg/L
cis-1,2-Dichloroethene	ND	5 µg/L
2-Dichlorobenzene (o-DCB)	ND	5 µg/L
3-Dichlorobenzene (m-DCB)	ND	5 µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5 µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5 µg/L
2-Dichloroethane (1,2-DCA)	ND	5 µg/L
1-Dichloroethene (1,1-DCE)	ND	5 µg/L
trans-1,2-Dichloroethene	ND	5 µg/L
2-Dichloropropane	ND	5 µg/L
s-1,3-Dichloropropene	ND	5 µg/L
rans-1,3-Dichloropropene	ND	5 µg/L
Ethylbenzene	ND	2 µg/L
ethylene chloride (Dichloromethane)	ND	5 µg/L
1,2,2-Tetrachloroethane	ND	5 µg/L
Tetrachloroethene (PCE)	ND	5 µg/L
oluene	ND	2 µg/L
1,1-Trichloroethane (1,1,1-TCA)	ND	5 µg/L
1,2-Trichloroethane (1,1,2-TCA)	ND	5 µg/L
Trichloroethene (TCE)	ND	5 µg/L
richlorofluoromethane (Freon 11)	ND	5 µg/L
inyl chloride	ND	5 µg/L
m,p-Xylene	ND	2 µg/L
Xylene	ND	2 µg/L

UALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
-Bromofluorobenzene	102	86 - 115
ibromofluoromethane	107	86 - 118
oluene-d8	102	88 - 110

D - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	1/30/97
CLIENT ID:	**Travel Blank**	NEL SAMPLE ID:	P9702008-06

TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
METHOD:	EPA 624	ANALYST:	JW
MATRIX:	Aqueous	EXTRACTED:	3/4/97
DILUTION:	1	ANALYZED:	3/4/97

PARAMETER	Result	Reporting Limit
Benzene	ND	2 µg/L
Bromodichloromethane	ND	5 µg/L
Bromoform	ND	5 µg/L
Bromomethane	ND	5 µg/L
Carbon tetrachloride	ND	5 µg/L
Chlorobenzene	ND	5 µg/L
Chloroethane	ND	5 µg/L
2-Chloroethylvinyl ether	ND	5 µg/L
Chloroform	ND	5 µg/L
Chloromethane	ND	5 µg/L
Dibromochloromethane	ND	5 µg/L
cis-1,2-Dichloroethene	ND	5 µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5 µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5 µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5 µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5 µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5 µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5 µg/L
trans-1,2-Dichloroethene	ND	5 µg/L
1,2-Dichloropropane	ND	5 µg/L
cis-1,3-Dichloropropene	ND	5 µg/L
trans-1,3-Dichloropropene	ND	5 µg/L
Ethylbenzene	ND	2 µg/L
Methylene chloride (Dichloromethane)	ND	5 µg/L
1,1,2,2-Tetrachloroethane	ND	5 µg/L
Tetrachloroethene (PCE)	ND	5 µg/L
Toluene	ND	2 µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5 µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5 µg/L
Trichloroethene (TCE)	ND	5 µg/L
Trichlorofluoromethane (Freon 11)	ND	5 µg/L
Vinyl chloride	ND	5 µg/L
m,p-Xylene	ND	2 µg/L
o-Xylene	ND	2 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	101	86- 115
Dibromofluoromethane	107	86- 118
Toluene-d8	101	88- 110

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
CLIENT ID:	**Method Blank**	NEL SAMPLE ID:	030497-E1 -BLK
TEST:	**Organochlorine Pesticides and PCB's by EPA 608, July 1993**		
METHOD:	EPA 608	ANALYST:	YW
MATRIX:	Aqueous	EXTRACTED:	3/4/97
		ANALYZED:	3/6/97

PARAMETER	Result	Reporting Limit
Aldrin	ND	0.1 µg/L
alpha-BHC	ND	0.1 µg/L
beta-BHC	ND	0.1 µg/L
delta-BHC	ND	0.1 µg/L
Heptachlor	ND	0.1 µg/L
Chlordane	ND	0.1 µg/L
4,4'-DDD	ND	0.5 µg/L
4,4'-DDE	ND	0.1 µg/L
4,4'-DDT	ND	0.1 µg/L
Dieldrin	ND	0.1 µg/L
Endosulfan I	ND	0.1 µg/L
Endosulfan II	ND	0.1 µg/L
Endosulfan sulfate	ND	0.1 µg/L
Endrin	ND	0.1 µg/L
Endrin aldehyde	ND	0.1 µg/L
Heptachlor epoxide	ND	0.1 µg/L
Lindane (gamma-BHC)	ND	0.1 µg/L
Methoxychlor	ND	0.5 µg/L
Toxaphene	ND	2 µg/L
Arochlor-1016	ND	0.5 µg/L
Arochlor-1221	ND	0.5 µg/L
Arochlor-1232	ND	0.5 µg/L
Arochlor-1242	ND	0.5 µg/L
Arochlor-1248	ND	0.5 µg/L
Arochlor-1254	ND	0.5 µg/L
Arochlor-1260	ND	0.5 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
Decachlorobiphenyl	25	70- 130
Tetrachloro-m-xylene	89	70- 130

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
CLIENT ID:	**Method Blank**	NEL SAMPLE ID:	030497A62 -BLK

TEST:	**Purgeable Organic Contaminants by EPA 624, July 1993**		
METHOD:	EPA 624	ANALYST:	JW
MATRIX:	Aqueous	EXTRACTED:	3/4/97
		ANALYZED:	3/4/97

PARAMETER	Result	Reporting Limit
Benzene	ND	2 µg/L
Bromodichloromethane	ND	5 µg/L
Bromoform	ND	5 µg/L
Bromomethane	ND	5 µg/L
Carbon tetrachloride	ND	5 µg/L
Chlorobenzene	ND	5 µg/L
Chloroethane	ND	5 µg/L
2-Chloroethylvinyl ether	ND	5 µg/L
Chloroform	ND	5 µg/L
Chloromethane	ND	5 µg/L
Dibromochloromethane	ND	5 µg/L
cis-1,2-Dichloroethene	ND	5 µg/L
1,2-Dichlorobenzene (o-DCB)	ND	5 µg/L
1,3-Dichlorobenzene (m-DCB)	ND	5 µg/L
1,4-Dichlorobenzene (p-DCB)	ND	5 µg/L
1,1-Dichloroethane (1,1-DCA)	ND	5 µg/L
1,2-Dichloroethane (1,2-DCA)	ND	5 µg/L
1,1-Dichloroethene (1,1-DCE)	ND	5 µg/L
trans-1,2-Dichloroethene	ND	5 µg/L
1,2-Dichloropropane	ND	5 µg/L
cis-1,3-Dichloropropene	ND	5 µg/L
trans-1,3-Dichloropropene	ND	5 µg/L
Ethylbenzene	ND	2 µg/L
Methylene chloride (Dichloromethane)	ND	5 µg/L
1,1,2,2-Tetrachloroethane	ND	5 µg/L
Tetrachloroethene (PCE)	ND	5 µg/L
Toluene	ND	2 µg/L
1,1,1-Trichloroethane (1,1,1-TCA)	ND	5 µg/L
1,1,2-Trichloroethane (1,1,2-TCA)	ND	5 µg/L
Trichloroethene (TCE)	ND	5 µg/L
Trichlorofluoromethane (Freon 11)	ND	5 µg/L
Vinyl chloride	ND	5 µg/L
m,p-Xylene	ND	2 µg/L
o-Xylene	ND	2 µg/L

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
4-Bromofluorobenzene	101	86 - 115
Dibromofluoromethane	105	86 - 118
Toluene-d8	105	88 - 110

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #2 (2)**

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-01

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Copper	0.013	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/5/97	3/5/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/5/97	3/5/97
Zinc	0.035	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: Location #3 (2)

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-02

TEST: Priority 13 Metals
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Copper	0.020	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/5/97	3/5/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/5/97	3/5/97
Zinc	0.13	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: Location #2 (1)

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-03

TEST: Priority 13 Metals
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Copper	0.017	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/5/97	3/5/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/5/97	3/5/97
Zinc	0.054	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: Location #1 (1)

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-04

TEST: Priority 13 Metals
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Copper	0.071	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/5/97	3/5/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/5/97	3/5/97
Zinc	0.32	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: Location #1 (2)

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-05

TEST: Priority 13 Metals
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Copper	0.021	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/5/97	3/5/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/5/97	3/5/97
Zinc	0.073	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Method Blank**

NEL ORDER ID: P9702008
DATE SAMPLED: NA
NEL SAMPLE ID: P9702008 -BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97
Copper	ND	0.005 mg/L	1	EPA 6010A	3/5/97	3/5/97
Lead	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	3/5/97	3/5/97
Silver	ND	0.02 mg/L	1	EPA 6010A	3/5/97	3/5/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	3/5/97	3/5/97
Zinc	ND	0.01 mg/L	1	EPA 6010A	3/5/97	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Method Blank**

NEL ORDER ID: P9702008
DATE SAMPLED: NA
NEL SAMPLE ID: P9702008H-BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Mercury	ND	0.1 mg/L	1	EPA 7470A	3/5/97	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	2/27/97
CLIENT ID:	Location #1 (1)	NEL SAMPLE ID:	P9702008-04

TEST:	**Semi-Volatile Organic Compounds by EPA 625, July 1993**		
METHOD:	EPA 625	EXTRACTED:	3/6/97
MATRIX:	Aqueous	ANALYZED:	3/6/97
DILUTION:	10	ANALYST:	JW

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acenaphthene	ND	100.µg/L	Hexachlorobutadiene	ND	100.µg/L
Acenaphthylene	ND	100.µg/L	Hexachloroethane	ND	100.µg/L
Anthracene	ND	100.µg/L	Hexachlorocyclopentadiene	ND	100.µg/L
Benzo (a) anthracene	ND	100.µg/L	Indeno (1,2,3-c,d) pyrene	ND	100.µg/L
Benzo (b&k) fluoranthene	ND	100.µg/L	Isophorone	ND	100.µg/L
Benzo (a) pyrene	ND	100.µg/L	4,6-Dinitro-2-methyl phenol	ND	100.µg/L
Benzo (g,h,i) perylene	ND	100.µg/L	Naphthalene	ND	100.µg/L
Butylbenzylphthalate	ND	100.µg/L	Nitrobenzene	ND	100.µg/L
bis (2-Chloroethyl) ether	ND	100.µg/L	2-Nitrophenol	ND	100.µg/L
bis (2-Chloroethoxy) methane	ND	100.µg/L	4-Nitrophenol	ND	100.µg/L
bis (2-chloroisopropyl) ether	ND	100.µg/L	N-Nitrosodi-n-propylamine	ND	100.µg/L
bis (2-Ethylhexyl)phthalate	ND	100.µg/L	N-Nitroso-Dimethylamine	ND	100.µg/L
4-Bromophenyl phenyl ether	ND	500.µg/L	N-Nitrosodiphenylamine	ND	100.µg/L
4-Chloro-3-methyl phenol	ND	100.µg/L	Pentachlorophenol	ND	100.µg/L
2-Chloronaphthalene	ND	100.µg/L	Phenol	ND	100.µg/L
2-Chlorophenol	ND	100.µg/L	Phenanthrene	ND	500.µg/L
4-Chlorophenyl phenyl ether	ND	200.µg/L	Pyrene	ND	100.µg/L
Chrysene	ND	100.µg/L	1,2,4-Trichlorobenzene	ND	100.µg/L
Dibenz [a,h] Anthracene	ND	100.µg/L	2,4,6-Trichlorophenol	ND	100.µg/L
Di-n-butyl phthalate	ND	100.µg/L			
1,2-Dichlorobenzene (o-DCB)	ND	100.µg/L			
1,3-Dichlorobenzene (m-DCB)	ND	100.µg/L			
1,4-Dichlorobenzene (p-DCB)	ND	100.µg/L			
2,4-Dichlorophenol	ND	100.µg/L			
3,3'-Dichlorobenzidine	ND	100.µg/L			
Diethylphthalate	ND	100.µg/L			
2,4-Dimethylphenol	ND	100.µg/L			
Dimethylphthalate	ND	100.µg/L			
2,4-Dinitrotoluene	ND	500.µg/L			
2,6-Dinitrotoluene	ND	100.µg/L			
2,4-Dinitrophenol	ND	100.µg/L			
Di-n-octyl phthalate	ND	100.µg/L			
Fluoranthene	ND	100.µg/L			
Fluorene	ND	100.µg/L			
Hexachlorobenzene	ND	100.µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
2,4,6-Tribromophenol	75	19 - 122
2-Fluorobiphenyl	71	30 - 115
2-Fluorophenol	39	25 - 121
Nitrobenzene-d5	76	23 - 120
p-Terphenyl-d14	78	18 - 137
Phenol-d5	28	24 - 113

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	2/27/97
CLIENT ID:	Location #1 (2)	NEL SAMPLE ID:	P9702008-05

TEST:	Semi-Volatile Organic Compounds by EPA 625, July 1993		
METHOD:	EPA 625	EXTRACTED:	3/6/97
MATRIX:	Aqueous	ANALYZED:	3/6/97
DILUTION:	1	ANALYST:	JW

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acenaphthene	ND	10.µg/L	Hexachlorobutadiene	ND	10.µg/L
Acenaphthylene	ND	10.µg/L	Hexachloroethane	ND	10.µg/L
Anthracene	ND	10.µg/L	Hexachlorocyclopentadiene	ND	10.µg/L
Benzo (a) anthracene	ND	10.µg/L	Indeno (1,2,3-c,d) pyrene	ND	10.µg/L
Benzo (b&k) fluoranthene	ND	10.µg/L	Isophorone	ND	10.µg/L
Benzo (a) pyrene	ND	10.µg/L	4,6-Dinitro-2-methyl phenol	ND	10.µg/L
Benzo (g,h,i) perylene	ND	10.µg/L	Naphthalene	ND	10.µg/L
Butylbenzylphthalate	ND	10.µg/L	Nitrobenzene	ND	10.µg/L
bis (2-Chloroethyl) ether	ND	10.µg/L	2-Nitrophenol	ND	10.µg/L
bis (2-Chloroethoxy) methane	ND	10.µg/L	4-Nitrophenol	ND	10.µg/L
bis (2-chloroisopropyl) ether	ND	10.µg/L	N-Nitrosodi-n-propylamine	ND	10.µg/L
bis (2-Ethylhexyl)phthalate	ND	10.µg/L	N-Nitroso-Dimethylamine	ND	10.µg/L
4-Bromophenyl phenyl ether	ND	50.µg/L	N-Nitrosodiphenylamine	ND	10.µg/L
4-Chloro-3-methyl phenol	ND	10.µg/L	Pentachlorophenol	ND	10.µg/L
2-Chloronaphthalene	ND	10.µg/L	Phenol	ND	10.µg/L
2-Chlorophenol	ND	10.µg/L	Phenanthrene	ND	50.µg/L
4-Chlorophenyl phenyl ether	ND	20.µg/L	Pyrene	ND	10.µg/L
Chrysene	ND	10.µg/L	1,2,4-Trichlorobenzene	ND	10.µg/L
Dibenz [a,h] Anthracene	ND	10.µg/L	2,4,6-Trichlorophenol	ND	10.µg/L
Di-n-butyl phthalate	ND	10.µg/L			
1,2-Dichlorobenzene (o-DCB)	ND	10.µg/L			
1,3-Dichlorobenzene (m-DCB)	ND	10.µg/L			
1,4-Dichlorobenzene (p-DCB)	ND	10.µg/L			
2,4-Dichlorophenol	ND	10.µg/L			
3,3'-Dichlorobenzidine	ND	10.µg/L			
Diethylphthalate	ND	10.µg/L			
2,4-Dimethylphenol	ND	10.µg/L			
Dimethylphthalate	ND	10.µg/L			
2,4-Dinitrotoluene	ND	50.µg/L			
2,6-Dinitrotoluene	ND	10.µg/L			
2,4-Dinitrophenol	ND	10.µg/L			
Di-n-octyl phthalate	ND	10.µg/L			
Fluoranthene	ND	10.µg/L			
Fluorene	ND	10.µg/L			
Hexachlorobenzene	ND	10.µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
2,4,6-Tribromophenol	63	19 - 122
2-Fluorobiphenyl	57	30 - 115
2-Fluorophenol	32	25 - 121
Nitrobenzene-d5	56	23 - 120
p-Terphenyl-d14	69	18 - 137
Phenol-d5	23	24 - 113

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9702008
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
CLIENT ID:	**Method Blank**	NEL SAMPLE ID:	030697A62 -BLK

TEST:	**Semi-Volatile Organic Compounds by EPA 625, July 1993**		
METHOD:	EPA 625	ANALYST:	JW
MATRIX:	Aqueous	EXTRACTED:	3/6/97
		ANALYZED:	3/6/97

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acenaphthene	ND	10µg/L	Hexachlorobenzene	ND	10µg/L
Acenaphthylene	ND	10µg/L	Hexachlorobutadiene	ND	10µg/L
Anthracene	ND	10µg/L	Hexachloroethane	ND	10µg/L
Benzo (a) anthracene	ND	10µg/L	Hexachlorocyclopentadiene	ND	10µg/L
Benzo (b&k) fluoranthene	ND	10µg/L	Indeno (1,2,3-c,d) pyrene	ND	10µg/L
Benzo (a) pyrene	ND	10µg/L	Isophorone	ND	10µg/L
Benzo (g,h,i) perylene	ND	10µg/L	4,6-Dinitro-2-methyl phenol	ND	10µg/L
Butylbenzylphthalate	ND	10µg/L	Naphthalene	ND	10µg/L
bis (2-Chloroethyl) ether	ND	10µg/L	Nitrobenzene	ND	10µg/L
bis (2-Chloroethoxy) methane	ND	10µg/L	2-Nitrophenol	ND	10µg/L
bis (2-chloroisopropyl) ether	ND	10µg/L	4-Nitrophenol	ND	10µg/L
bis (2-Ethylhexyl)phthalate	ND	10µg/L	N-Nitrosodi-n-propylamine	ND	10µg/L
4-Bromophenyl phenyl ether	ND	50µg/L	N-Nitroso-Dimethylamine	ND	10µg/L
4-Chloro-3-methyl phenol	ND	10µg/L	N-Nitrosodiphenylamine	ND	10µg/L
2-Chloronaphthalene	ND	10µg/L	Pentachlorophenol	ND	10µg/L
2-Chlorophenol	ND	10µg/L	Phenol	ND	10µg/L
4-Chlorophenyl phenyl ether	ND	20µg/L	Phenanthrene	ND	50µg/L
Chrysene	ND	10µg/L	Pyrene	ND	10µg/L
Dibenz [a,h] Anthracene	ND	10µg/L	1,2,4-Trichlorobenzene	ND	10µg/L
Di-n-butyl phthalate	ND	10µg/L	2,4,6-Trichlorophenol	ND	10µg/L
1,2-Dichlorobenzene (o-DCB)	ND	10µg/L			
1,3-Dichlorobenzene (m-DCB)	ND	10µg/L			
1,4-Dichlorobenzene (p-DCB)	ND	10µg/L			
2,4-Dichlorophenol	ND	10µg/L			
3,3'-Dichlorobenzidine	ND	10µg/L			
Diethylphthalate	ND	10µg/L			
2,4-Dimethylphenol	ND	10µg/L			
Dimethylphthalate	ND	10µg/L			
2,4-Dinitrotoluene	ND	50µg/L			
2,6-Dinitrotoluene	ND	10µg/L			
2,4-Dinitrophenol	ND	10µg/L			
Di-n-octyl phthalate	ND	10µg/L			
Fluoranthene	ND	10µg/L			
Fluorene	ND	10µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
2,4,6-Tribromophenol	56	19- 122
2-Fluorobiphenyl	60	30- 115
2-Fluorophenol	36	25- 121
Nitrobenzene-d5	60	23- 120
p-Terphenyl-d14	69	18- 137
Phenol-d5	25	24- 113

ND - Not Detected

This report shall not be reproduced except in full, without the written approval of the laboratory.

NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #2 (2)**

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-01

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	2	1	1	EPA 413.1	mg/L	3/5/97
Total Suspended Solids	4.4	2	1	SM 2540 D	mg/L	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #3 (2)**

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-02

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	11	1	1	EPA 413.1	mg/L	3/5/97
Total Suspended Solids	58.5	2	1	SM 2540 D	mg/L	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #2 (1)**

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-03

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	2	1	1	EPA 413.1	mg/L	3/5/97
Total Suspended Solids	57.8	2	1	SM 2540 D	mg/L	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #1 (1)**

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-04

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Nitrate, as N	2.6	0.1	1	EPA 300.0	mg/L-N	3/1/97
Nitrite, as N	ND	0.1	1	EPA 300.0	mg/L-N	3/1/97
Oil & Grease	5	1	1	EPA 413.1	mg/L	3/5/97
Sulfate	43	0.1	1	EPA 300.0	mg/L	3/1/97
Total Cyanide	ND	0.02	1	SM 4500-CN G	mg/L	3/5/97
Total Phosphorous	0.50	0.01	1	SM 4500-P E	mg/L-P	3/4/97
Total Suspended Solids	56.2	2	1	SM 2540 D	mg/L	3/4/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #1 (2)**

NEL ORDER ID: P9702008
DATE SAMPLED: 2/27/97
NEL SAMPLE ID: P9702008-05

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Nitrate, as N	0.4	0.1	1	EPA 300.0	mg/L-N	3/1/97
Nitrite, as N	ND	0.1	1	EPA 300.0	mg/L-N	3/1/97
Oil & Grease	4	1	1	EPA 413.1	mg/L	3/5/97
Sulfate	3.3	0.1	1	EPA 300.0	mg/L	3/1/97
Total Cyanide	ND	0.02	1	SM 4500-CN G	mg/L	3/5/97
Total Phosphorous	0.32	0.01	1	SM 4500-P E	mg/L-P	3/4/97
Total Suspended Solids	99.2	2	1	SM 2540 D	mg/L	3/5/97

D.F. - Dilution Factor

ND - Not Detected

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CTS

ANALYTICAL REPORT

Client:	NEL Laboratories	**Date Received:**	02/27/97
Project:	Kimley Horn: MCFCD	**Date Analyzed:**	02/27/97
Sample Matrix:	Water	**P. O. Number:**	None

Coliform, Fecal (MPN)
SM 18-9221 B & C
MPN Index/100 ml

Sample Name	Laboratory I.D. No.	Result
Location #1-FC-1	9700053	30
Location #3-FC-2	9700054	≥1600
Location #1-FC-2	9700055	17
Location #2-FC-1	9700056	≥1600
Location #2-FC-2	9700057	80

Approved by: Dennis Miller Date: 3-2-97

NEL LABORATORIES
Reno • Las Vegas • Phoenix

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: Additional 625 (DWP) results for report #P9702008. MCFCD

FROM: Dolby

PAGE 1 of 2

DATE: 3/12/97

TIME:

NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Duplicate**

NEL ORDER ID: P9702008
DATE SAMPLED: NA
NEL SAMPLE ID: P9702008-04 DUP

TEST: **Semi-Volatile Organic Compounds by EPA 625, July 1993**
METHOD: EPA 625
MATRIX: Aqueous
DILUTION: 1

EXTRACTED: 3/6/97
ANALYZED: 3/6/97

PARAMETER	Result µg/L	Reporting Limit	PARAMETER	Result µg/L	Reporting Limit
Acenaphthene	ND	10 µg/L	Hexachlorobutadiene	ND	10 µg/L
Acenaphthylene	ND	10 µg/L	Hexachloroethane	ND	10 µg/L
Anthracene	ND	10 µg/L	Hexachlorocyclopentadiene	ND	10 µg/L
Benzo (a) anthracene	ND	10 µg/L	Indeno (1,2,3-c,d) pyrene	ND	10 µg/L
Benzo (b&k) fluoranthene	ND	10 µg/L	Isophorone	ND	10 µg/L
Benzo (a) pyrene	ND	10 µg/L	4,6-Dinitro-2-methyl phenol	ND	10 µg/L
Benzo (g,h,i) perylene	ND	10 µg/L	Naphthalene	ND	10 µg/L
Butylbenzylphthalate	ND	10 µg/L	Nitrobenzene	ND	10 µg/L
bis (2-Chloroethyl) ether	ND	10 µg/L	2-Nitrophenol	ND	10 µg/L
bis (2-Chloroethoxy) methane	ND	10 µg/L	4-Nitrophenol	ND	10 µg/L
bis (2-chloroisopropyl) ether	ND	10 µg/L	N-Nitrosodi-n-propylamine	ND	10 µg/L
bis (2-Ethylhexyl)phthalate	ND	10 µg/L	N-Nitroso-Dimethylamine	ND	10 µg/L
4-Bromophenyl phenyl ether	ND	50 µg/L	N-Nitrosodiphenylamine	ND	10 µg/L
4-Chloro-3-methyl phenol	ND	10 µg/L	Pentachlorophenol	ND	10 µg/L
2-Chloronaphthalene	ND	10 µg/L	Phenol	ND	10 µg/L
2-Chlorophenol	ND	10 µg/L	Phenanthrene	ND	50 µg/L
4-Chlorophenyl phenyl ether	ND	20 µg/L	Pyrene	ND	10 µg/L
Chrysene	ND	10 µg/L	1,2,4-Trichlorobenzene	ND	10 µg/L
Dibenz [a,h] Anthracene	ND	10 µg/L	2,4,6-Trichlorophenol	ND	10 µg/L
Di-n-butyl phthalate	ND	10 µg/L			
1,2-Dichlorobenzene (o-DCB)	ND	10 µg/L			
1,3-Dichlorobenzene (m-DCB)	ND	10 µg/L			
1,4-Dichlorobenzene (p-DCB)	ND	10 µg/L			
2,4-Dichlorophenol	ND	10 µg/L			
3,3'-Dichlorobenzidine	ND	10 µg/L			
Diethylphthalate	ND	10 µg/L			
2,4-Dimethylphenol	ND	10 µg/L			
Dimethylphthalate	ND	10 µg/L			
2,4-Dinitrotoluene	ND	50 µg/L			
2,6-Dinitrotoluene	ND	10 µg/L			
2,4-Dinitrophenol	ND	10 µg/L			
Di-n-octyl phthalate	ND	10 µg/L			
Fluoranthene	ND	10 µg/L			
Fluorene	ND	10 µg/L			
Hexachlorobenzene	ND	10 µg/L			

QUALITY CONTROL DATA:

Surrogate	% Recovery	Acceptable Range
2,4,6-Tribromophenol	63	33 - 141
2-Fluorobiphenyl	53	43 - 116
2-Fluorophenol	28	21 - 100
Nitrobenzene-d5	51	35 - 114
p-Terphenyl-d14	79	33 - 141
Phenol-d5	23	10 - 94

ND - Not Detected

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1-800-368-5221

FACSIMILE TRANSMISSION

ATTENTION: Bruce Wilcox

COMPANY: Kimley-Horn

PHONE #:

FAX #: 602-944-7423

MESSAGE: Report #P9704001
Kimley-Horn: MCFCD

COD results are still pending.

FROM: Dolly

PAGE 1 of 11

DATE: 4/9/97

TIME:

NEL LABORATORIES
Reno • Las Vegas
Phoenix • Burbank

Reno Division
1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Kimley-Horn
7600 N. 15th St. #250
Phoenix, AZ 85020

ATTN: Bruce Wilcox

PROJECT NAME: Kimley-Horn: MCFCD NEL ORDER ID: P9704001

Attached are the analytical results for samples in support of the above referenced project.

Samples submitted for this project were not sampled by NEL Laboratories. Samples were received by NEL in good condition, under chain of custody on 4/2/97 .

Samples were analyzed as received.

Where applicable we have included the following quality control data:

Method blank - used to demonstrate absence of contamination or interferences in the Analytical process.
Laboratory Control Spike (LCS) - used to demonstrate laboratory ability to perform the method within specifications by spiking representative analytes into a clean matrix.
Surrogates - compounds added to each sample to ensure that the method requirements are met for each individual sample.

Should you have any questions or comments, please feel free to contact our Client Services department at (602) 437-0099 .

TSS and Oil & Grease analyses were performed by NEL-Las Vegas.

Eileen M. Ferguson
Eileen M. Ferguson
Laboratory Manager

4/9/97
Date

CERTIFICATIONS:

	Reno	Las Vegas
Arizona	AZ0520	AZ0518
California	1707	2002
US Army Corps of Engineers		

	Reno	Las Vegas
Idaho	Certified	Certified
Nevada	NV033	NV052
Montana	Certified	Certified

NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-1**

NEL ORDER ID: P9704001
DATE SAMPLED: 4/2/97
NEL SAMPLE ID: P9704001-01

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	0.026	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	0.21	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #1-1**

NEL ORDER ID: P9704001
DATE SAMPLED: 4/2/97
NEL SAMPLE ID: P9704001-02

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	0.053	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	0.25	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: Location #3-1

NEL ORDER ID: P9704001
DATE SAMPLED: 4/2/97
NEL SAMPLE ID: P9704001-03

TEST: Priority 13 Metals
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	0.062	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97
Nickel	0.076	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	0.15	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Method Blank**

NEL ORDER ID: P9704001
DATE SAMPLED: NA
NEL SAMPLE ID: P04001/2 -BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Method Blank**

NEL ORDER ID: P9704001
DATE SAMPLED: NA
NEL SAMPLE ID: P04001HG -BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-1**

NEL ORDER ID: P9704001
DATE SAMPLED: 4/2/97
NEL SAMPLE ID: P9704001-01

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	4.8	1	1	EPA 413.1	mg/L	4/7/97
Total Suspended Solids	24	2	1	SM 2540 D	mg/L	4/3/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #1-1**

NEL ORDER ID: P9704001
DATE SAMPLED: 4/2/97
NEL SAMPLE ID: P9704001-02

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	5.2	1	1	EPA 413.1	mg/L	4/7/97
Total Suspended Solids	24	2	1	SM 2540 D	mg/L	4/3/97

D.F. - Dilution Factor

ND - Not Detected

This report shall not be reproduced except in full, without the written approval of the laboratory.

NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #3-1**

NEL ORDER ID: P9704001
DATE SAMPLED: 4/2/97
NEL SAMPLE ID: P9704001-03

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	4.7	1	1	EPA 413.1	mg/L	4/7/97
Total Suspended Solids	30	2	1	SM 2540 D	mg/L	4/3/97

D.F. - Dilution Factor

ND - Not Detected

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CTS

ANALYTICAL REPORT

Client:	NEL Laboratories	Date Received:	04/02/97
Project:	Kinney Horn: MCFCD	Date Analyzed:	04/02/97
Sample Matrix:	Water	P. O. Number:	None

Coliform, Fecal (MPN)
SM 18-9221 B & C
MPN Index/100 ml

Sample Name	Laboratory I.D. No.	Result
Location #4-1	9700061	≥1600
Location #1-1	9700062	1600
Location #3-1	9700063	≥1600

Approved by: Dennis Miller Date: 4-7-97

NEL LABORATORIES
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Phoenix • Burbank

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1030 Matley Lane • Reno, Nevada 89502
(702) 348-2522 • Fax: (702) 348-2546
1-800-368-5221

CLIENT: Kimley-Horn
7600 N. 15th St. #250
Phoenix, AZ 85020

ATTN: Bruce Wilcox

PROJECT NAME: Kimley-Horn: MCFCD NEL ORDER ID: P9704002

Attached are the analytical results for samples in support of the above referenced project.

Samples submitted for this project were not sampled by NEL Laboratories. Samples were received by NEL in good condition, under chain of custody on 4/3/97 .

Samples were analyzed as received.

Where applicable we have included the following quality control data:

Method blank - used to demonstrate absence of contamination or interferences in the Analytical process.
Laboratory Control Spike (LCS) - used to demonstrate laboratory ability to perform the method within specifications by spiking representative analytes into a clean matrix.
Surrogates - compounds added to each sample to ensure that the method requirements are met for each individual sample.

Should you have any questions or comments, please feel free to contact our Client Services department at (602) 437-0099 .

TSS and Oil & Grease analyses were performed by NEL-Las Vegas.

Eileen M. Ferguson
Laboratory Manager

Date

CERTIFICATIONS:

	Reno	Las Vegas
Arizona	AZ0520	AZ0518
California	1707	2002
US Army Corps of Engineers		

	Reno	Las Vegas
Idaho	Certified	Certified
Nevada	NV033	NV052
Montana	Certified	Certified

NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-2**

NEL ORDER ID: P9704002
DATE SAMPLED: 4/3/97
NEL SAMPLE ID: P9704002-01

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #3-2**

NEL ORDER ID: P9704002
DATE SAMPLED: 4/3/97
NEL SAMPLE ID: P9704002-02

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	0.022	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	0.097	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #1-2**

NEL ORDER ID: P9704002
DATE SAMPLED: 4/3/97
NEL SAMPLE ID: P9704002-03

TEST: **Priority 13 Metals**
MATRIX: Aqueous

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	0.039	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	0.25	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Method Blank**

NEL ORDER ID: P9704002
DATE SAMPLED: NA
NEL SAMPLE ID: P04001/2 -BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Antimony	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Arsenic	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Beryllium	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Cadmium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Chromium	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97
Copper	ND	0.005 mg/L	1	EPA 6010A	4/8/97	4/8/97
Lead	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Nickel	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Selenium	ND	0.05 mg/L	1	EPA 6010A	4/8/97	4/8/97
Silver	ND	0.02 mg/L	1	EPA 6010A	4/8/97	4/8/97
Thallium	ND	0.1 mg/L	1	EPA 6010A	4/8/97	4/8/97
Zinc	ND	0.01 mg/L	1	EPA 6010A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT:	Kimley-Horn	NEL ORDER ID:	P9704002
PROJECT ID:	Kimley-Horn: MCFCD	DATE SAMPLED:	NA
CLIENT ID:	**Method Blank**	NEL SAMPLE ID:	P04001HG -BLK

TEST: **Priority 13 Metals**

PARAMETER	RESULT mg/L	REPORTING LIMIT	D. F.	METHOD	DIGESTED	ANALYZED
Mercury	ND	0.1 mg/L	1	EPA 7470A	4/8/97	4/8/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #4-2**

NEL ORDER ID: P9704002
DATE SAMPLED: 4/3/97
NEL SAMPLE ID: P9704002-01

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	ND	1	1	EPA 413.1	mg/L	4/7/97
Total Suspended Solids	5.2	2	1	SM 2540 D	mg/L	4/7/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #3-2**

NEL ORDER ID: P9704002
DATE SAMPLED: 4/3/97
NEL SAMPLE ID: P9704002-02

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	2.2	1	1	EPA 413.1	mg/L	4/7/97
Total Suspended Solids	14	2	1	SM 2540 D	mg/L	4/7/97

D.F. - Dilution Factor

ND - Not Detected

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NEL LABORATORIES

CLIENT: Kimley-Horn
PROJECT ID: Kimley-Horn: MCFCD
CLIENT ID: **Location #1-2**

NEL ORDER ID: P9704002
DATE SAMPLED: 4/3/97
NEL SAMPLE ID: P9704002-03

TEST: **Inorganic Non-Metals**
MATRIX: Aqueous

PARAMETER	RESULT	REPORTING LIMIT	D. F.	METHOD	UNITS	ANALYZED
Oil & Grease	7.8	1	1	EPA 413.1	mg/L	4/7/97
Total Suspended Solids	22	2	1	SM 2540 D	mg/L	4/7/97

D.F. - Dilution Factor

ND - Not Detected

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CTS

ANALYTICAL REPORT

Client: NEL Laboratories
Project: Kimley Horn: MCFCD
Sample Matrix: Water

Date Received: 04/03/97
Date Analyzed: 04/03/97
P. O. Number: None

Coliform, Fecal (MPN)
SM 18-9221 B & C
MPN Index/100 ml

Sample Name	Laboratory I.D. No.	Result
Location #4-2	9700064	50
Location #3-2	9700065	≥1600
Location #1-2	9700066	170

Approved by: [signature] Date: 4-7-97

Appendix C - Utility Conflicts

Appendix C - Utility Conflicts

Purpose

This appendix includes any supporting documentation for the utility conflicts analysis for the project. It should be used to support the conclusions in the main body of the report.

Supporting Documentation

The supporting documentation in this appendix is the project correspondence and the calculations for determining probable costs for utility conflicts.

Project Correspondence

Upon submittal of the Draft Recommended Plan, copies of the preliminary plans were sent to the City of Scottsdale, City of Phoenix, Arizona Public Service, Salt River Project (Water), Salt River Project (Electric), US West, and Southwest Gas Corporation. Each utility company was asked to verify the location of their underground facilities for both horizontal and vertical locations.

The City of Scottsdale, Arizona Public Service, Salt River Project (Water), and US West all returned plan mark-ups and a letter. Southwest Gas Corporation returned a letter only. The City of Phoenix and Salt River Project (Electric) failed to respond prior to the preparation of our final submittal for this project. These responses were reviewed and followed up with phone calls, as necessary, to allow us to incorporate their comments into the plan set. Copies of the letters are provided in Appendix G for future reference. The following table provides a summary of issues for consideration during final design.

Utility Company	Contact Person	Utility Issue
Salt River Project (Water)	Robert Mauer	The Cross Cut Canal does not have regularly scheduled dry-up months for maintenance due to fish populations. Bob should be contacted at least six months in advance of any construction to schedule a maintenance dry-up of the Cross Cut Canal to coincide with the construction schedule for the project.
		18" minimum separation between any proposed storm drain and the invert of the Cross Cut Canal will be required. The canal is lined with approximately 4" of concrete in these locations.
		Any irrigation lines should be replaced will be RGRCP
City of Scottsdale Utilities	Larry Tritz	All water main and gravity sewer crossings should be replaced with ductile iron pipe.
		All sewer services to be replaced should start at the connection to the sewer main.
		All water services should be replaced with copper.
APS	Steve Goodman	APS will brace and support all crossings of their facilities at no cost to the City.
Southwest Gas Corporation	Bob Sprague	Need to maintain 12" minimum clearance at all crossings.

Twelve copies of the Draft Recommended Plan were also submitted to the District and the steering committee. Five sets of written comments were received as shown in the attached letters. These comments were then discussed with the steering committee and incorporated into the plan sets. Written responses to each of the comments are provided in Appendix F of this report.

Probable Costs for Utility Conflicts

Discussion of utility conflicts revealed that it is difficult to determine the exact nature and costs associated with utility conflicts based on a set of preliminary design plans. To assist the District, we have evaluated two separate conditions for measuring utility conflicts.

Best Case Scenario

All utility crossings which do not conflict with the proposed improvements are designated as 'protect in place' items. All utility crossings which are in conflict with the proposed improvements are designated as 'reconstruct' items. All skewed crossings or parallel utilities which fall within 5' of the outside limits of the proposed improvements are designated 'recontruct' utilities. This is the scenario which is shown on the preliminary plans and included in the cost estimates in the main body of the report.

Worst Case Scenario

Same as 'Best Case Scenario' except that parallel utilities within 10' are designated 'reconstruct' items. This cost estimate is considered a high end estimate of the potential utility costs for consideration during final design.

These two scenarios were evaluated sheet by sheet using the following unit cost table as summarized in the following utlity conflict summary tables. Unit Costs were based primarily on the 10th Annual Edition of the Means Heavy Construction Data and a facsimile from Dave Meinhart, City of Scottsdale (See Project Correspondence in Appendix G). The other utility companies and the District were contacted to discuss these estimates, but could not provide any additional supporting documentation for use in this study.

Unit Cost Table

Description	Units	Rate	Source
Remove 18" RCP	lf	$6.00	Means Cost Data
Remove 24" RCP	lf	$8.50	Means Cost Data
Remove 36" RCP	lf	$10.50	Means Cost Data
Remove 42" RCP	lf	$13.00	Means Cost Data
Remove 45"/48" RCP	lf	$15.00	Means Cost Data
Remove 60" RCP	lf	$25.00	Means Cost Data
Remove 66" RCP	lf	$30.00	Means Cost Data
Remove 72" RCP	lf	$35.00	Means Cost Data
12" RGRCP	lf	$50.00	FCDMC Bid Tabs
15" RGRCP	lf	$65.00	FCDMC Bid Tabs
18" RGRCP	lf	$80.00	FCDMC Bid Tabs
24" RGRCP	lf	$95.00	FCDMC Bid Tabs
30" RGRCP	lf	$120.00	FCDMC Bid Tabs
36" RGRCP	lf	$145.00	FCDMC Bid Tabs
42" RGRCP	lf	$160.00	FCDMC Bid Tabs
45"/48" RGRCP	lf	$175.00	FCDMC Bid Tabs
54" RGRCP	lf	$205.00	FCDMC Bid Tabs
57"/60" RGRCP	lf	$235.00	FCDMC Bid Tabs
66" RGRCP	lf	$250.00	FCDMC Bid Tabs
72" RGRCP	lf	$260.00	FCDMC Bid Tabs
75"/78" RGRCP	lf	$280.00	FCDMC Bid Tabs
84" RGRCP	lf	$350.00	FCDMC Bid Tabs
90" RGRCP	lf	$400.00	FCDMC Bid Tabs
102" RGRCP	lf	$550.00	FCDMC Bid Tabs
114" RGRCP	lf	$650.00	FCDMC Bid Tabs
Transition Structure	ea	$20,000.00	FCDMC Bid Tabs
Manhole (24"-48")	ea	$3,000.00	FCDMC Bid Tabs
Junction Box (>48")	ea	$20,000.00	FCDMC Bid Tabs
Reconstruct Curb Drop Inlet	ea	$5,000.00	FCDMC Bid Tabs
Inlet / Outlet Works	ea	$50,000.00	FCDMC Bid Tabs
Structural Concrete	cy	$330.00	FCDMC Bid Tabs
Reinforcing Steel	lb	$0.50	FCDMC Bid Tabs

Description	Units	Rate	Source
Basin Excavation	cy	$6.00	FCDMC Bid Tabs
Construct Conc. Walk / Canal	sf	$4.00	FCDMC Bid Tabs
Concrete Pipe Plug	ea	$1,000.00	Means Cost Data
Protect in Place, Exist. Tel. Line	ea	$1,000.00	Means Cost Data
Reconstruct Tel. Line	lf	$12.00	Means Cost Data
Protect in Place, Exist. Gas Line	ea	$1,000.00	Means Cost Data
Reconstruct Gas Service	ea	$1,000.00	Means Cost Data
Reconstruct 2" G	lf	$12.00	Means Cost Data
Protect in Place, Exist. Irr. Line	ea	$1,000.00	Means Cost Data
Reconstruct 12" Irr. Pipe	lf	$50.00	FCDMC Bid Tabs
Reconstruct 18" Irr. Pipe	lf	$75.00	FCDMC Bid Tabs
Reconstruct 24" Irr. Pipe	lf	$95.00	FCDMC Bid Tabs
Reconstruct SRP Junction Box	ea	$3,000.00	Means Cost Data
Protect in Place, Exist. SRP(E)	ea	$1,000.00	Means Cost Data
Reconstruct Exist. Power Pole	ea	$5,000.00	Means Cost Data
Reconstruct Water Service	ea	$1,000.00	Means Cost Data
Reconstruct 2" W	lf	$15.00	COS Facsimile
Reconstruct 4" W	lf	$25.00	COS Facsimile
Reconstruct 6" W	lf	$30.00	COS Facsimile
Reconstruct 8" W	lf	$35.00	COS Facsimile
Reconstruct 12" W	lf	$42.00	COS Facsimile
Reconstruct 16"/18"/20" W	lf	$80.00	COS Facsimile
Reconstruct 24" W	lf	$100.00	COS Facsimile
Reconstruct 36" W	lf	$200.00	COS Facsimile
Reconstruct Fire Hydrant	ea	$5,000.00	Means Cost Data
Reconstruct 6" SS	lf	$50.00	COS Facsimile
Reconstruct 8" SS	lf	$58.00	COS Facsimile
Reconstruct 10" SS	lf	$62.00	COS Facsimile
Reconstruct 12" SS	lf	$65.00	COS Facsimile
Reconstruct 15" SS	lf	$80.00	COS Facsimile
Reconstruct 18" SS	lf	$90.00	COS Facsimile
Reconstruct SSMH	ea	$3,000.00	Means Cost Data

Oak Street Outfall - Best Case Scenario

Sheet	Station	Description	Quantity	Units	Rate	Amount
3	Parallel	Reconstruct 2" G	120	lf	$12.00	$1,440.00
	Parallel	Remove Dual 48" RCP	850	lf	$30.00	$25,500.00
	1349	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1380	Reconstruct Conc. Sidewalk	760	sf	$4.00	$3,040.00
	1405	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1440	Reconstruct 6" W	70	lf	$30.00	$2,100.00
	1445	Reconstruct 2" G	70	lf	$12.00	$840.00
	1515	Reconstruct 8" W	70	lf	$35.00	$2,450.00
	1520	Reconstruct 12" SS	70	lf	$66.00	$4,620.00
	1540	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
	1550	Reconstruct SRP Junction Box	1	ea	$3,000.00	$3,000.00
	1550	Reconstruct 12" Irr. Pipe	12	lf	$50.00	$600.00
	1555	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1565	Reconstruct 8" W	50	lf	$35.00	$1,750.00
4	Parallel	Remove Dual 48" RCP	410	lf	$30.00	$12,300.00
	Parallel	Remove Dual 42" RCP	590	lf	$26.00	$15,340.00
	Parallel	Reconstruct Water Services	4	ea	$1,000.00	$4,000.00
	Parallel	Reconstruct 2" G	780	lf	$12.00	$9,360.00
	Parallel	Reconstruct 18" Irr. Pipe	325	lf	$75.00	$24,375.00
	Parallel	Reconstruct 12" Irr. Pipe	350	lf	$50.00	$17,500.00
	Parallel	Reconstruct Tel. Line	680	lf	$12.00	$8,160.00
	1915	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	1915	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2110	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	2117	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	2178	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
	2330	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	2355	Reconstruct 12" RCP	28	lf	$50.00	$1,400.00
	2355	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2505	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
	2783	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	2790	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2815	Protect in Place, Exist. Tel.	1	ea	$1,000.00	$1,000.00
	2840	Reconstruct 8" SS	50	lf	$58.00	$2,900.00
	2778	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
5	Parallel	Remove Dual 42" RCP	1000	lf	$26.00	$26,000.00
	Parallel	Reconstruct Water Services	11	ea	$1,000.00	$11,000.00
	Parallel	Reconstruct 2" G	155	lf	$12.00	$1,860.00
	Parallel	Reconstruct 18" Irr. Pipe	110	lf	$75.00	$8,250.00
	2855	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	2860	Reconstruct 2" G	50	lf	$12.00	$600.00
	2900	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	3670	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	3633	Reconstruct 12" RCP	12	lf	$50.00	$600.00

Oak Street Outfall - Best Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
5 (cont.)	3815	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	3822	Protect in Place, Exist. Tel.	1	ea	$1,000.00	$1,000.00
6	Parallel	Remove Dual 42" RCP	355	lf	$26.00	$9,230.00
	Parallel	Remove 42" RCP	585	lf	$13.00	$7,605.00
	Parallel	Remove 36" RCP	60	lf	$10.50	$630.00
	Parallel	Reconstruct Water Services	5	ea	$1,000.00	$5,000.00
	Parallel	Reconstruct Gas Services	9	ea	$1,000.00	$9,000.00
	Parallel	Reconstruct 2" G	750	lf	$12.00	$9,000.00
	4075	Protect in Place, Exist. Irr. Line	1	ea	$1,000.00	$1,000.00
	4125	Reconstruct 18" SS	50	lf	$90.00	$4,500.00
	4140	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	4160	Protect in Place, Exist. Irr. Line	1	ea	$1,000.00	$1,000.00
	4165	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	4175	Reconstruct 12" W	50	lf	$42.00	$2,100.00
	4190	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4222	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	4222	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
	4615	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4720	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4765	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	4775	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
	4790	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
7	Parallel	Remove 36" RCP	640	lf	$10.50	$6,720.00
	Parallel	Reconstruct Water Services	13	ea	$1,000.00	$13,000.00
	Parallel	Reconstruct Gas Services	6	ea	$1,000.00	$6,000.00
	Parallel	Reconstruct 2" G	690	lf	$12.00	$8,280.00
	Parallel	Reconstruct 20" W	220	lf	$80.00	$17,600.00
	5435	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5440	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	5460	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
	5460	Reconstruct 36" RCP	12	lf	$145.00	$1,740.00
8	Parallel	Reconstruct Water Services	3	ea	$1,000.00	$3,000.00
	Parallel	Reconstruct Gas Services	3	ea	$1,000.00	$3,000.00
	6100	Reconstruct 8" W	80	lf	$35.00	$2,800.00
	6120	Reconstruct 8" W	36	lf	$35.00	$1,260.00
	6715	Reconstruct 8" W	36	lf	$35.00	$1,260.00
	6805	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	6815	Reconstruct 8" W	36	lf	$35.00	$1,260.00
	6830	Reconstruct 6" W	28	lf	$30.00	$840.00
	6830	Reconstruct Fire Hydrant	1	ea	$5,000.00	$5,000.00
9	Parallel	Reconstruct 20" W	350	lf	$80.00	$28,000.00
	Parallel	Reconstruct 2" G	260	lf	$12.00	$3,120.00
	Parallel	Reconstruct Water Services	11	ea	$1,000.00	$11,000.00
	7835	Reconstruct 6" W	45	lf	$30.00	$1,350.00

Oak Street Outfall - Best Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
10	Parallel	Reconstruct 2" G	470	lf	$12.00	$5,640.00
	Parallel	Reconstruct Water Services	8	ea	$1,000.00	$8,000.00
	7860	Reconstruct 6" W	45	lf	$30.00	$1,350.00
	7975	Reconstruct Conc. Canal	2000	sf	$4.00	$8,000.00
	8020	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	8028	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	8035	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	8158	Reconstruct 8" W	45	lf	$35.00	$1,575.00
11	Parallel	Reconstruct Water Services	7	ea	$1,000.00	$7,000.00
	Parallel	Reconstruct 2" G	200	lf	$12.00	$2,400.00
	9140	Reconstruct 6" W	40	lf	$30.00	$1,200.00
	9360	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9372	Reconstruct 6" W	40	lf	$30.00	$1,200.00
	9380	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9395	Reconstruct 24" W	40	lf	$100.00	$4,000.00
	9430	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	9435	Reconstruct 15" RCP	30	lf	$65.00	$1,950.00
	9450	Reconstruct 8" SS	40	lf	$58.00	$2,320.00
	9455	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	9655	Reconstruct 6" W	35	lf	$30.00	$1,050.00
	9693	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9698	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
12	10020	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	10085	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	10095	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	10405	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	10490	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	10495	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	10715	Reconstruct Water Services	1	ea	$1,000.00	$1,000.00
	10765	Reconstruct 8" W	34	lf	$35.00	$1,190.00
13	10860	Reconstruct 8" W	40	lf	$35.00	$1,400.00
	11120	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	11825	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
14	12055	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	12105	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	12112	Reconstruct 24" W	34	lf	$100.00	$3,400.00
	12123	Reconstruct 12" W	44	lf	$42.00	$1,848.00
	12145	Reconstruct 20" W	44	lf	$80.00	$3,520.00
	12155	Reconstruct 6" W	34	lf	$30.00	$1,020.00
15	13045	Reconstruct 20" W	40	lf	$80.00	$3,200.00
	13055	Reconstruct 12" W	40	lf	$42.00	$1,680.00
16	1010	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1020	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1020	Reconstruct 6" SS	36	lf	$50.00	$1,800.00

Oak Street Outfall - Best Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
16 (cont.)	1024	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1030	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1030	Reconstruct 15" RCP	12	lf	$65.00	$780.00
	1135	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1140	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1405	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1670	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1950	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
17	1962	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	2070	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	2100	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2105	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
18	Parallel	Reconstruct Tel. Line	900	lf	$12.00	$10,800.00
	Parallel	Reconstruct Water Services	2	ea	$1,000.00	$2,000.00
	1030	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	1050	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1280	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1290	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	1305	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1550	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1703	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1708	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	1715	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1818	Reconstruct 6" W	36	lf	$30.00	$1,080.00
19	Parallel	Reconstruct Tel. Line	775	lf	$12.00	$9,300.00
	Parallel	Pipe Plug at McDowell Road	2	ea	$1,000.00	$2,000.00
	1952	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	2090	Reconstruct 6" W	40	lf	$30.00	$1,200.00
	2410	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2412	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	2520	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	2675	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	2680	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
		Subtotal Utility Conflicts Cost				$568,803
		Contingency @ 50%				$284,402
		Total Utility Conflicts Budget				**$853,205**

Oak Street Outfall - Worst Case Scenario

Sheet	Station	Description	Quantity	Units	Rate	Amount
3	Parallel	Reconstruct 2" G	120	lf	$12.00	$1,440.00
	Parallel	Reconstruct 18" W	312	lf	$80.00	$24,960.00
	Parallel	Remove Dual 48" RCP	850	lf	$30.00	$25,500.00
	1349	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1380	Reconstruct Conc. Sidewalk	760	sf	$4.00	$3,040.00
	1405	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1440	Reconstruct 6" W	70	lf	$30.00	$2,100.00
	1445	Reconstruct 2" G	70	lf	$12.00	$840.00
	1515	Reconstruct 8" W	70	lf	$35.00	$2,450.00
	1520	Reconstruct 12" SS	70	lf	$66.00	$4,620.00
	1540	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
	1550	Reconstruct SRP Junction Box	1	ea	$3,000.00	$3,000.00
	1550	Reconstruct 12" Irr. Pipe	12	lf	$50.00	$600.00
	1555	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1565	Reconstruct 8" W	50	lf	$35.00	$1,750.00
4	Parallel	Remove Dual 48" RCP	410	lf	$30.00	$12,300.00
	Parallel	Remove Dual 42" RCP	590	lf	$26.00	$15,340.00
	Parallel	Reconstruct Water Services	4	ea	$1,000.00	$4,000.00
	Parallel	Reconstruct 18" W	1000	lf	$80.00	$80,000.00
	Parallel	Reconstruct 2" G	780	lf	$12.00	$9,360.00
	Parallel	Reconstruct 18" Irr. Pipe	325	lf	$75.00	$24,375.00
	Parallel	Reconstruct 12" Irr. Pipe	350	lf	$50.00	$17,500.00
	Parallel	Reconstruct Tel. Line	680	lf	$12.00	$8,160.00
	1915	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	1915	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2110	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	2117	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	2178	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
	2330	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	2355	Reconstruct 12" RCP	28	lf	$50.00	$1,400.00
	2355	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2505	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
	2783	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	2790	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2815	Protect in Place, Exist. Tel.	1	ea	$1,000.00	$1,000.00
	2840	Reconstruct 8" SS	50	lf	$58.00	$2,900.00
	2778	Reconstruct Exist. Power Pole	1	ea	$5,000.00	$5,000.00
5	Parallel	Remove Dual 42" RCP	1000	lf	$26.00	$26,000.00
	Parallel	Reconstruct Water Services	11	ea	$1,000.00	$11,000.00
	Parallel	Reconstruct 2" G	155	lf	$12.00	$1,860.00
	Parallel	Reconstruct 18" W	1000	lf	$80.00	$80,000.00
	Parallel	Reconstruct 18" Irr. Pipe	110	lf	$75.00	$8,250.00
	Parallel	Reconstruct Tel. Line	25	lf	$12.00	$300.00
	2855	Reconstruct 6" W	50	lf	$30.00	$1,500.00

Oak Street Outfall - Worst Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
5 (cont.)	2860	Reconstruct 2" G	50	lf	$12.00	$600.00
	2900	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	3670	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	3633	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	3815	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	3822	Protect in Place, Exist. Tel.	1	ea	$1,000.00	$1,000.00
6	Parallel	Remove Dual 42" RCP	355	lf	$26.00	$9,230.00
	Parallel	Remove 42" RCP	585	lf	$13.00	$7,605.00
	Parallel	Remove 36" RCP	60	lf	$10.50	$630.00
	Parallel	Reconstruct Water Services	5	ea	$1,000.00	$5,000.00
	Parallel	Reconstruct 20" W	675	lf	$80.00	$54,000.00
	Parallel	Reconstruct 18" W	360	lf	$80.00	$28,800.00
	Parallel	Reconstruct Gas Services	9	ea	$1,000.00	$9,000.00
	Parallel	Reconstruct Tel. Line	340	lf	$12.00	$4,080.00
	Parallel	Reconstruct 2" G	750	lf	$12.00	$9,000.00
	4075	Protect in Place, Exist. Irr. Line	1	ea	$1,000.00	$1,000.00
	4125	Reconstruct 18" SS	50	lf	$90.00	$4,500.00
	4140	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	4160	Protect in Place, Exist. Irr. Line	1	ea	$1,000.00	$1,000.00
	4165	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	4175	Reconstruct 12" W	50	lf	$42.00	$2,100.00
	4190	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4222	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	4222	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
	4615	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4720	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4765	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	4775	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
	4790	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
7	Parallel	Remove 36" RCP	640	lf	$10.50	$6,720.00
	Parallel	Reconstruct Water Services	13	ea	$1,000.00	$13,000.00
	Parallel	Reconstruct Gas Services	6	ea	$1,000.00	$6,000.00
	Parallel	Reconstruct 2" G	690	lf	$12.00	$8,280.00
	Parallel	Reconstruct 20" W	1000	lf	$80.00	$80,000.00
	Parallel	Reconstruct 24" Irr.	135	lf	$95.00	$12,825.00
	5435	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5440	Reconstruct 6" W	50	lf	$30.00	$1,500.00
	5460	Reconstruct 24" RCP	12	lf	$95.00	$1,140.00
	5460	Reconstruct 36" RCP	12	lf	$145.00	$1,740.00
	Parallel	Reconstruct 24" Irr.	1000	lf	$95.00	$95,000.00
8	Parallel	Reconstruct 20" W	1000	lf	$80.00	$80,000.00
	Parallel	Reconstruct Water Services	3	ea	$1,000.00	$3,000.00
	Parallel	Reconstruct Gas Services	3	ea	$1,000.00	$3,000.00
	6100	Reconstruct 8" W	80	lf	$35.00	$2,800.00

Oak Street Outfall - Worst Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
8 (cont.)	6120	Reconstruct 8" W	36	lf	$35.00	$1,260.00
	6715	Reconstruct 8" W	36	lf	$35.00	$1,260.00
	6805	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	6815	Reconstruct 8" W	36	lf	$35.00	$1,260.00
	6830	Reconstruct 6" W	28	lf	$30.00	$840.00
	6830	Reconstruct Fire Hydrant	1	ea	$5,000.00	$5,000.00
9	Parallel	Reconstruct 24" Irr.	640	lf	$95.00	$60,800.00
	Parallel	Reconstruct 20" W	930	lf	$80.00	$74,400.00
	Parallel	Reconstruct 2" G	260	lf	$12.00	$3,120.00
	Parallel	Reconstruct Water Services	11	ea	$1,000.00	$11,000.00
	7835	Reconstruct 6" W	45	lf	$30.00	$1,350.00
10	Parallel	Reconstruct 2" G	470	lf	$12.00	$5,640.00
	Parallel	Reconstruct Water Services	8	ea	$1,000.00	$8,000.00
	7860	Reconstruct 6" W	45	lf	$30.00	$1,350.00
	7975	Reconstruct Conc. Canal	2000	sf	$4.00	$8,000.00
	8020	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	8028	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	8035	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	8158	Reconstruct 8" W	45	lf	$35.00	$1,575.00
11	Parallel	Reconstruct Water Services	8	ea	$1,000.00	$8,000.00
	Parallel	Reconstruct 2" G	200	lf	$12.00	$2,400.00
	9140	Reconstruct 6" W	40	lf	$30.00	$1,200.00
	9360	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9372	Reconstruct 6" W	40	lf	$30.00	$1,200.00
	9380	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9395	Reconstruct 24" W	40	lf	$100.00	$4,000.00
	9430	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	9435	Reconstruct 15" RCP	30	lf	$65.00	$1,950.00
	9450	Reconstruct 8" SS	40	lf	$58.00	$2,320.00
	9455	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	9655	Reconstruct 6" W	35	lf	$30.00	$1,050.00
	9693	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9698	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
12	10020	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	10085	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	10095	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	10405	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	10490	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	10495	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	10715	Reconstruct Water Services	1	ea	$1,000.00	$1,000.00
	10765	Reconstruct 8" W	34	lf	$35.00	$1,190.00
13	10860	Reconstruct 8" W	40	lf	$35.00	$1,400.00
	11120	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	11825	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
14	12055	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	12105	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00

Oak Street Outfall - Worst Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
14 (cont.)	12112	Reconstruct 24" W	34	lf	$100.00	$3,400.00
	12123	Reconstruct 12" W	44	lf	$42.00	$1,848.00
	12145	Reconstruct 20" W	44	lf	$80.00	$3,520.00
	12155	Reconstruct 6" W	34	lf	$30.00	$1,020.00
15	13045	Reconstruct 20" W	40	lf	$80.00	$3,200.00
	13055	Reconstruct 12" W	40	lf	$42.00	$1,680.00
16	1010	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1020	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1020	Reconstruct 6" SS	36	lf	$50.00	$1,800.00
	1024	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1030	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1030	Reconstruct 15" RCP	12	lf	$65.00	$780.00
	1135	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1140	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1405	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1670	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1950	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
17	1962	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	2070	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	2100	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2105	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
18	Parallel	Reconstruct Tel. Line	900	lf	$12.00	$10,800.00
	Parallel	Reconstruct Water Services	2	ea	$1,000.00	$2,000.00
	1030	Protect in Place, Exist. SRP(E)	1	ea	$1,000.00	$1,000.00
	1050	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1280	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1290	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	1305	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1550	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	1703	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	1708	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	1715	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	1818	Reconstruct 6" W	36	lf	$30.00	$1,080.00
19	Parallel	Reconstruct Tel. Line	775	lf	$12.00	$9,300.00
	Parallel	Reconstruct 8"SS	590	lf	$58.00	$34,220.00
	Parallel	Reconstruct SSMH	2	ea	$3,000.00	$6,000.00
	Parallel	Pipe Plug at McDowell Road	2	ea	$1,000.00	$2,000.00
	1952	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	2090	Reconstruct 6" W	40	lf	$30.00	$1,200.00
	2410	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2412	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	2520	Reconstruct 6" W	36	lf	$30.00	$1,080.00
	2675	Reconstruct 8" SS	36	lf	$58.00	$2,088.00
	2680	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
		Subtotal Utility Conflicts Cost				$1,239,588
		Contingency @ 50%				$619,794
		Total Utility Conflicts Budget				**$1,859,382**

Osborn Road Outfall - Best Case Scenario

Sheet	Station	Description	Quantity	Units	Rate	Amount
21		Use Exist. Storm Drain Only				
22	Parallel	Remove 8'x5' CBC	90	lf	$100.00	$9,000.00
	Parallel	Remove 48" RCP	55	lf	$15.00	$825.00
	Parallel	Pipe Plug	3	ea	$1,000.00	$3,000.00
	Parallel	Reconstruct Exist. Tel. Line	80	lf	$12.00	$960.00
	Parallel	Reconstruct Exist. Tel. Line	80	lf	$12.00	$960.00
	Parallel	Reconstruct 48" Irr. Line	45	lf	$175.00	$7,875.00
	2460	Reconstruct 12" W	45	lf	$42.00	$1,890.00
	2475	Reconstruct 42" RCP	12	lf	$160.00	$1,920.00
	2485	Reconstruct 54" RCP	12	lf	$205.00	$2,460.00
	2500	Reconstruct 8" W	45	lf	$35.00	$1,575.00
	2505	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2510	Reconstruct 15" SS	28	lf	$80.00	$2,240.00
	2520	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2535	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	2540	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2585	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2595	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	2595	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
23	Parallel	Remove 72" RCP	660	lf	$35.00	$23,100.00
	Parallel	Pipe Plug	1	ea	$1,000.00	$1,000.00
	Parallel	Reconstruct Water Service	5	ea	$1,000.00	$5,000.00
	Parallel	Protect in Place, Gas Service	1	ea	$1,000.00	$1,000.00
	2670	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2675	Reconstruct 4" W	28	lf	$25.00	$700.00
	2805	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	2855	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	2895	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	3005	Reconstruct 4" W	28	lf	$25.00	$700.00
	3155	Reconstruct 18" RCP	20	lf	$80.00	$1,600.00
	3155	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	3220	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	3310	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	3470	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	3505	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	3630	Reconstruct 72" RCP	15	lf	$260.00	$3,900.00
24	Parallel	Remove 60" RCP	40	lf	$25.00	$1,000.00
	Parallel	Remove 48" RCP	310	lf	$15.00	$4,650.00
	Parallel	Reconstruct Water Service	1	ea	$1,000.00	$1,000.00
	Parallel	Reconstruct Gas Service	1	ea	$1,000.00	$1,000.00
	3790	Reconstruct 6" W	25	lf	$30.00	$750.00
	3835	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	3870	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4345	Reconstruct 18" RCP	12	lf	$80.00	$960.00

Osborn Road Outfall - Best Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
24 (cont.)	4365	Reconstruct 4" W	25	lf	$25.00	$625.00
	4475	Reconstruct 6" W	25	lf	$30.00	$750.00
	4500	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	4500	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	4615	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	4650	Reconstruct 18" RCP	12	lf	$80.00	$960.00
25	Parallel	Remove 48" RCP	360	lf	$15.00	$5,400.00
	Parallel	Remove 66" RCP	20	lf	$30.00	$600.00
	Parallel	Remove 45" RCP	20	lf	$15.00	$300.00
	Parallel	Remove 24" RCP	225	lf	$8.50	$1,912.50
	Parallel	Reconstruct 8" W	175	lf	$35.00	$6,125.00
	Parallel	Reconstruct Water Service	4	ea	$1,000.00	$4,000.00
	4680	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4700	Reconstruct 48" RCP	12	lf	$175.00	$2,100.00
	4715	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	4730	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4750	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	5040	Reconstruct 6" SS	30	lf	$50.00	$1,500.00
	5102	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	5105	Reconstruct 24" Irr. Pipe	35	lf	$95.00	$3,325.00
	5115	Reconstruct 2" G	30	lf	$12.00	$360.00
	5117	Reconstruct 6" W	30	lf	$30.00	$900.00
	5125	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5130	Reconstruct 66" RCP	12	lf	$250.00	$3,000.00
	5150	Reconstruct 45" RCP	12	lf	$175.00	$2,100.00
	5152	Reconstruct 2" W	30	lf	$15.00	$450.00
	5155	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5157	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	5165	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	5170	Reconstruct 8" W	30	lf	$35.00	$1,050.00
	5195	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	5205	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	5215	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	5350	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	5380	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5402	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	5408	Reconstruct 8" SS	25	lf	$58.00	$1,450.00
	5435	Reconstruct 6" W	25	lf	$30.00	$750.00
26	Parallel	Remove 24" RCP	825	lf	$8.50	$7,012.50
	Parallel	Remove 18" RCP	175	lf	$6.00	$1,050.00
	Parallel	Reconstruct Water Service	3	ea	$1,000.00	$3,000.00
	Parallel	Reconstruct Gas Service	5	ea	$1,000.00	$5,000.00
	5780	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	5805	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00

Osborn Road Outfall - Best Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
26 (cont.)	5840	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	5965	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	6000	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	6030	Reconstruct 12" RCP	12	lf	$12.00	$144.00
	6155	Reconstruct 6" W	28	lf	$30.00	$840.00
	6380	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	6410	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	6430	Reconstruct 2" G	28	lf	$12.00	$336.00
	6430	Reconstruct 8" SS	35	lf	$58.00	$2,030.00
	6450	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
	6455	Reconstruct 6" W	28	lf	$30.00	$840.00
	6465	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	6480	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	6483	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	6627	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	6637	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
27	Parallel	Remove 18" RCP	1000	lf	$6.00	$6,000.00
	Parallel	Reconstruct Gas Service	13	ea	$1,000.00	$13,000.00
	Parallel	Reconstruct Exist. Tel. Line	270	lf	$12.00	$3,240.00
	6935	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
	7240	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
	7245	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
28	Parallel	Remove 18" RCP	100	lf	$6.00	$600.00
	Parallel	Reconstruct Water Service	1	ea	$1,000.00	$1,000.00
	7705	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	7707	Reconstruct 8" W	28	lf	$35.00	$980.00
	7715	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	7735	Reconstruct 20" W	28	lf	$80.00	$2,240.00
	7745	Reconstruct 16" W	28	lf	$80.00	$2,240.00
	7760	Reconstruct 12" RCP	16	lf	$50.00	$800.00
	7780	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	7800	Reconstruct 12" W	28	lf	$42.00	$1,176.00
	8040	Reconstruct 6" W	28	lf	$30.00	$840.00
	8180	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	8190	Reconstruct 10" SS	40	lf	$62.00	$2,480.00
	8340	Reconstruct 6" W	28	lf	$30.00	$840.00
	8635	Reconstruct 6" W	28	lf	$30.00	$840.00
29	8925	Reconstruct 6" W	24	lf	$30.00	$720.00
	9025	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	9035	Reconstruct 10" SS	38	lf	$62.00	$2,356.00
	9050	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	9060	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9090	Protect in Place, Exist. Irr. Line	1	ea	$1,000.00	$1,000.00
30	9850	Reconstruct 8" SS	38	lf	$58.00	$2,204.00
	9855	Reconstruct 18" Irr	38	lf	$80.00	$3,040.00

Osborn Road Outfall - Best Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
31		OHE and fence relocated with roadway project				
32	Parallel	Reconstruct 6" W	200	lf	$30.00	$6,000.00
	Parallel	Reconstruct Water Service	8	ea	$1,000.00	$8,000.00
	12260	Reconstruct Conc. Canal	2000	sf	$4.00	$8,000.00
33	Parallel	Reconstruct Water Service	23	ea	1,000.00	$23,000.00
	Parallel	Reconstruct Sewer Service	6	ea	1,000.00	$6,000.00
	12750	Reconstruct 6" W	28	lf	30.00	$840.00
	12755	Reconstruct Exist. Tel. Line	28	lf	12.00	$336.00
	12760	Reconstruct 8" SS	28	lf	58.00	$1,624.00
	13320	Reconstruct 6" W	28	lf	30.00	$840.00
34	Parallel	Reconstruct 6" W	145	lf	30.00	$4,350.00
	Parallel	Reconstruct Water Service	9	ea	1,000.00	$9,000.00
	Parallel	Reconstruct Sewer Service	9	ea	1,000.00	$9,000.00
	14115	Protect in Place, Exist. Gas Line	1	ea	1,000.00	$1,000.00
	14120	Protect in Place, Exist. Elec. Line	1	ea	1,000.00	$1,000.00
	14180	Reconstruct 6" W	24	lf	30.00	$720.00
	14460	Reconstruct 6" W	24	lf	30.00	$720.00
	14475	Protect in Place, Exist. Elec. Line	1	ea	1,000.00	$1,000.00
	14485	Protect in Place, Exist. Gas Line	1	ea	1,000.00	$1,000.00
	14500	Protect in Place, Exist. Tel. Line	1	ea	1,000.00	$1,000.00
	14505	Reconstruct 36" W	24	lf	200.00	$4,800.00
35	14575	Reconstruct 8" SS	24	lf	58.00	$1,392.00
	14820	Reconstruct 24" W	30	lf	100.00	$3,000.00
	14830	Reconstruct 8" W	30	lf	35.00	$1,050.00
		Subtotal Utility Conflicts Cost				$347,079
		Contingency @ 50%				$173,540
		Total Utility Conflicts Budget				**$520,619**

Osborn Road Outfall - Worst Case Scenario

Sheet	Station	Description	Quantity	Units	Rate	Amount
21		Use Exist. Storm Drain Only				
22	Parallel	Remove 8'x5' CBC	90	lf	$100.00	$9,000.00
	Parallel	Remove 48" RCP	55	lf	$15.00	$825.00
	Parallel	Pipe Plug	3	ea	$1,000.00	$3,000.00
	Parallel	Reconstruct Exist. Tel. Line	80	lf	$12.00	$960.00
	Parallel	Reconstruct Exist. Tel. Line	80	lf	$12.00	$960.00
	Parallel	Reconstruct 48" Irr. Line	45	lf	$175.00	$7,875.00
	Parallel	Reconstruct 12" SS	150	lf	$65.00	$9,750.00
	2460	Reconstruct 12" W	45	lf	$42.00	$1,890.00
	2475	Reconstruct 42" RCP	12	lf	$160.00	$1,920.00
	2485	Reconstruct 54" RCP	12	lf	$205.00	$2,460.00
	2500	Reconstruct 8" W	45	lf	$35.00	$1,575.00
	2505	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2510	Reconstruct 15" SS	28	lf	$80.00	$2,240.00
	2510	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	2520	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2535	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	2540	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2585	Reconstruct Curb Drop Inlet	1	ea	$5,000.00	$5,000.00
	2595	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	2595	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
23	Parallel	Remove 72" RCP	660	lf	$35.00	$23,100.00
	Parallel	Pipe Plug	1	ea	$1,000.00	$1,000.00
	Parallel	Reconstruct 12" SS	1000	lf	$65.00	$65,000.00
	Parallel	Reconstruct Water Service	5	ea	$1,000.00	$5,000.00
	Parallel	Protect in Place, Gas Service	1	ea	$1,000.00	$1,000.00
	Parallel	Reconstruct 8" W	500	lf	$35.00	$17,500.00
	2670	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	2675	Reconstruct 4" W	28	lf	$25.00	$700.00
	2805	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	2855	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	2895	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	3005	Reconstruct 4" W	28	lf	$25.00	$700.00
	3140	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	3155	Reconstruct 18" RCP	20	lf	$80.00	$1,600.00
	3155	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	3220	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	3310	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	3470	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	3505	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	3630	Reconstruct 72" RCP	15	lf	$260.00	$3,900.00
24	Parallel	Remove 60" RCP	40	lf	$25.00	$1,000.00
	Parallel	Remove 48" RCP	310	lf	$15.00	$4,650.00
	Parallel	Reconstruct 12" SS	1000	lf	$65.00	$65,000.00

Osborn Road Outfall - Worst Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
24 (cont.)	Parallel	Reconstruct 8" W	700	lf	$35.00	$24,500.00
	Parallel	Reconstruct 6" W	300	lf	$30.00	$9,000.00
	Parallel	Reconstruct Water Service	1	ea	$1,000.00	$1,000.00
	Parallel	Reconstruct Gas Service	1	ea	$1,000.00	$1,000.00
	3790	Reconstruct 6" W	25	lf	$30.00	$750.00
	3835	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	3835	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	3870	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4345	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	4365	Reconstruct 4" W	25	lf	$25.00	$625.00
	4410	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	4460	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	4475	Reconstruct 6" W	25	lf	$30.00	$750.00
	4500	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	4500	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	4615	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	4650	Reconstruct 18" RCP	12	lf	$80.00	$960.00
25	Parallel	Remove 48" RCP	360	lf	$15.00	$5,400.00
	Parallel	Remove 66" RCP	20	lf	$30.00	$600.00
	Parallel	Remove 45" RCP	20	lf	$15.00	$300.00
	Parallel	Remove 24" RCP	225	lf	$8.50	$1,912.50
	Parallel	Reconstruct 6" W	65	lf	$30.00	$1,950.00
	Parallel	Reconstruct 2" G	90	lf	$12.00	$1,080.00
	Parallel	Reconstruct 8" W	175	lf	$35.00	$6,125.00
	Parallel	Reconstruct 12" SS	240	lf	$65.00	$15,600.00
	Parallel	Reconstruct Water Service	4	ea	$1,000.00	$4,000.00
	4680	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4700	Reconstruct 48" RCP	12	lf	$175.00	$2,100.00
	4710	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	4715	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	4730	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	4750	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	4850	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	5040	Reconstruct 6" SS	30	lf	$50.00	$1,500.00
	5102	Reconstruct 8" SS	30	lf	$58.00	$1,740.00
	5105	Reconstruct 24" Irr. Pipe	35	lf	$95.00	$3,325.00
	5115	Reconstruct 2" G	30	lf	$12.00	$360.00
	5117	Reconstruct 6" W	30	lf	$30.00	$900.00
	5125	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5130	Reconstruct 66" RCP	12	lf	$250.00	$3,000.00
	5150	Reconstruct 45" RCP	12	lf	$175.00	$2,100.00
	5152	Reconstruct 2" W	30	lf	$15.00	$450.00
	5155	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5157	Reconstruct 18" RCP	12	lf	$80.00	$960.00

Osborn Road Outfall - Worst Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
26 (cont.)	5165	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	5170	Reconstruct 8" W	30	lf	$35.00	$1,050.00
	5195	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	5205	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	5215	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	5350	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	5380	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	5402	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	5408	Reconstruct 8" SS	25	lf	$58.00	$1,450.00
	5435	Reconstruct 6" W	25	lf	$30.00	$750.00
26	Parallel	Remove 24" RCP	825	lf	$8.50	$7,012.50
	Parallel	Remove 18" RCP	175	lf	$6.00	$1,050.00
	Parallel	Reconstruct Water Service	3	ea	$1,000.00	$3,000.00
	Parallel	Reconstruct Gas Service	5	ea	$1,000.00	$5,000.00
	Parallel	Reconstruct 2" G	1000	lf	$12.00	$12,000.00
	5780	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	5805	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	5840	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	5965	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	6000	Protect in Place, Exist. Elec. Line	1	ea	$1,000.00	$1,000.00
	6030	Reconstruct 12" RCP	12	lf	$12.00	$144.00
	6155	Reconstruct 6" W	28	lf	$30.00	$840.00
	6380	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	6410	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	6430	Reconstruct 2" G	28	lf	$12.00	$336.00
	6430	Reconstruct 8" SS	35	lf	$58.00	$2,030.00
	6450	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
	6455	Reconstruct 6" W	28	lf	$30.00	$840.00
	6465	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	6480	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	6483	Reconstruct 18" RCP	12	lf	$80.00	$960.00
	6627	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	6637	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
27	Parallel	Remove 18" RCP	1000	lf	$6.00	$6,000.00
	Parallel	Reconstruct 2" G	1000	lf	$12.00	$12,000.00
	Parallel	Reconstruct Gas Service	13	ea	$1,000.00	$13,000.00
	Parallel	Reconstruct Exist. Tel. Line	270	lf	$12.00	$3,240.00
	6935	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
	7240	Reconstruct 8" SS	28	lf	$58.00	$1,624.00
	7245	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
28	Parallel	Remove 18" RCP	100	lf	$6.00	$600.00
	Parallel	Reconstruct 2" G	600	lf	$12.00	$7,200.00
	Parallel	Reconstruct Water Service	1	ea	$1,000.00	$1,000.00
	7705	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	7707	Reconstruct 8" W	28	lf	$35.00	$980.00

Osborn Road Outfall - Worst Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
28 (cont.)	7715	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	7735	Reconstruct 20" W	28	lf	$80.00	$2,240.00
	7745	Reconstruct 16" W	28	lf	$80.00	$2,240.00
	7760	Reconstruct 12" RCP	16	lf	$50.00	$800.00
	7780	Reconstruct 12" RCP	12	lf	$50.00	$600.00
	7800	Reconstruct 12" W	28	lf	$42.00	$1,176.00
	8040	Reconstruct 6" W	28	lf	$30.00	$840.00
	8180	Reconstruct SSMH	1	ea	$3,000.00	$3,000.00
	8190	Reconstruct 10" SS	40	lf	$62.00	$2,480.00
	8340	Reconstruct 6" W	28	lf	$30.00	$840.00
	8635	Reconstruct 6" W	28	lf	$30.00	$840.00
29	8925	Reconstruct 6" W	24	lf	$30.00	$720.00
	9025	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	9035	Reconstruct 10" SS	38	lf	$62.00	$2,356.00
	9050	Protect in Place, Exist. Gas Line	1	ea	$1,000.00	$1,000.00
	9060	Protect in Place, Exist. Tel. Line	1	ea	$1,000.00	$1,000.00
	9090	Protect in Place, Exist. Irr. Line	1	ea	$1,000.00	$1,000.00
30	9850	Reconstruct 8" SS	38	lf	$58.00	$2,204.00
	9855	Reconstruct 18" Irr	38	lf	$80.00	$3,040.00
31		OHE and fence relocated with roadway project				
32	Parallel	Reconstruct 6" W	200	lf	$30.00	$6,000.00
	Parallel	Reconstruct Water Service	8	ea	$1,000.00	$8,000.00
	12260	Reconstruct Conc. Canal	2000	sf	$4.00	$8,000.00
33	Parallel	Reconstruct Water Service	23	ea	1,000.00	$23,000.00
	Parallel	Reconstruct Sewer Service	6	ea	1,000.00	$6,000.00
	Parallel	Reconstruct 8" SS	75	lf	58.00	$4,350.00
	12750	Reconstruct 6" W	28	lf	30.00	$840.00
	12755	Reconstruct Exist. Tel. Line	28	lf	12.00	$336.00
	12760	Reconstruct 8" SS	28	lf	58.00	$1,624.00
	13320	Reconstruct 6" W	28	lf	30.00	$840.00
34	Parallel	Reconstruct 8" SS	120	lf	58.00	$6,960.00
	Parallel	Reconstruct 6" W	145	lf	30.00	$4,350.00
	Parallel	Reconstruct Water Service	9	ea	1,000.00	$9,000.00
	Parallel	Reconstruct Sewer Service	9	ea	1,000.00	$9,000.00
	Parallel	Reconstruct Exist. Tel. Line	520	lf	12.00	$6,240.00
	Parallel	Reconstruct 36" W	30	lf	200.00	$6,000.00
	13600	Reconstruct SSMH	1	ea	3,000.00	$3,000.00
	13850	Reconstruct SSMH	1	ea	3,000.00	$3,000.00
	14115	Protect in Place, Exist. Gas Line	1	ea	1,000.00	$1,000.00
	14120	Protect in Place, Exist. Elec. Line	1	ea	1,000.00	$1,000.00
	14180	Reconstruct 6" W	24	lf	30.00	$720.00
	14460	Reconstruct 6" W	24	lf	30.00	$720.00
	14475	Protect in Place, Exist. Elec. Line	1	ea	1,000.00	$1,000.00
	14485	Protect in Place, Exist. Gas Line	1	ea	1,000.00	$1,000.00

Osborn Road Outfall - Worst Case Scenario (Cont.)

Sheet	Station	Description	Quantity	Units	Rate	Amount
34 (cont.)	14500	Protect in Place, Exist. Tel. Line	1	ea	1,000.00	$1,000.00
	14505	Reconstruct 36" W	24	lf	200.00	$4,800.00
35	Parallel	Reconstruct 36" W	250	lf	200.00	$50,000.00
	14575	Reconstruct 8" SS	24	lf	58.00	$1,392.00
	14820	Reconstruct 24" W	30	lf	100.00	$3,000.00
	14830	Reconstruct 8" W	30	lf	35.00	$1,050.00
		Subtotal Utility Conflicts Cost				$688,209
		Contingency @ 50%				$344,105
		Total Utility Conflicts Budget				**$1,032,314**

Appendix D - Hydrologic Analysis

Appendix D - Hydrologic Analysis

This hydrologic analysis for the STP Papago Watershed Study is formatted in accordance with Section 3 of the Technical Data Notebook standards as described in Arizona Department of Water Resources (ADWR) State Standards Attachment 1-90.

3.1 Method Description

Hydrologic modeling of the study area was performed using the U.S. Army Corps of Engineers Flood Hydrograph Package (HEC-1). The modeling was based on the HEC-1 files developed as part of the City of Scottsdale Stormwater Master Plan and Management Program. The results were reviewed and modified as needed for this project. In performing these revisions, care was taken to use the same methodology and sources as were used in the original HEC-1 files.

The City of Scottsdale Stormwater Master Plan and Management Program is based on the City of Scottsdale's Facility Management System (FMS). The FMS is a computerized database which uses spatial analysis techniques and computer programming to link the data and automate some of the hydrologic modeling. The linkage is shown schematically in this appendix.

3.2 Parameter Estimation

The parameters for the hydrologic analysis were initially based on the City of Scottsdale's HEC-1 files in the Stormwater Master Plan and Management Program. They include drainage area boundaries, precipitation depth, curve numbers, runoff zones, hydrologic soil conditions, percent impervious cover, land use, and overland flow parameters.

3.2.1 Drainage Area Boundaries

The drainage area boundaries were initially based on the City of Scottsdale's drainage area maps in the Stormwater Master Plan and Management Program. The boundaries were then verified and revised as described below.

3.2.2 Physical Parameters

The Natural Resource Conservation Service (formerly the Soil Conservation Service) curve number (CN) approach was used to estimate rainfall losses. This approach requires the determination of a curve number and a percentage of impervious surface for each subbasin. Curve numbers were selected based on the runoff zone (Figure 2), hydrologic soil group (Figure 3), and Table 1 for each subbasin. The percentage of impervious surface was determined based on the land use (Figure 4) and Table 2 for each subbasin.

The determination of each CN was made in the FMS by programming it to calculate a composite value based on the runoff zones and hydrologic soil groups in each subbasin. There is a provision in the FMS, however, to enter in a CN value for an area that does not fall into a generalized category and this will override the calculated CN. The determination of the percentage of impervious surface was also made in the FMS by programming it to calculate a composite value based on the land uses in each subbasin.

Runoff was computed using the kinematic overland flow option in HEC-1. This methodology uses overland flow planes to simulate watershed response. Pervious surface and impervious surface overland flow planes were utilized to represent runoff from each subbasin. Modeling was based on the assumption that the overland flow from both pervious and impervious surfaces has a uniform slope. The overland flow parameters for a specific subbasin were then selected in the FMS by programming it to calculate a composite value based on the land uses within the subbasin (Table 2).

Table 1 SCS Curve Numbers

Runoff Zone	Description of Vegetative Cover	Hydrologic Soil Group			
		A	B	C	D
1	Open space with grass cover < 50%	68	79	86	89
2	Open space with grass cover 50-75%	49	69	79	84
3	Desert shrub in poor condition	63	77	85	88

Table 2 Percent Impervious and Overland Flow Parameters

Land Use	Code	Percent Impervious	OVERLAND FLOW PARAMETERS					
			Pervious			Impervious		
			Length	Slope	Rough's	Length	Slope	Rough's
1. RESIDENTIAL								
1 DU PER 5 ACRES	10	7	300	0.0100	0.200	100	0.0100	0.100
1 DU PER 2-3 ACRES	11	15	300	0.0100	0.200	100	0.0100	0.100
1 DU PER 1-2 ACRES	12	15	300	0.0100	0.200	100	0.0100	0.100
1-2 DU PER ACRE	13	24	150	0.0100	0.300	50	0.0100	0.100
2-4 DU PER ACRE	14	35	150	0.0100	0.300	50	0.0100	0.100
4-8 DU PER ACRE	15	54	150	0.0100	0.300	50	0.0100	0.100
8-12 DU PER ACRE	16	74	20	0.0100	0.400	200	0.0100	0.100
12-22 DU PER ACRE	17	94	20	0.0100	0.400	200	0.0100	0.100
TOURIST ACCOMMODATIONS	18	85	150	0.0100	0.300	50	0.0100	0.100
LOW INTENSITY RESORT	19	85	150	0.0100	0.300	50	0.0100	0.100
RESIDENTIAL/HIGH DENSITY	RHD-2	85	20	0.0100	0.400	200	0.0100	0.100
RESIDENTIAL/HOTEL	RH-2	85	150	0.0100	0.300	50	0.0100	0.100
2. COMMERCIAL/OFFICE								
NEIGHBORHOOD COMMERCIAL	21	85	20	0.0100	0.400	200	0.0100	0.100
GENERAL COMMERCIAL	22	85	20	0.0100	0.400	200	0.0100	0.100
MINOR OFFICE	31	85	150	0.0100	0.300	50	0.0100	0.100
MAJOR OFFICE	32	85	20	0.0100	0.400	200	0.0100	0.100
MINOR EMPLOYMENT	33	85	20	0.0100	0.400	200	0.0100	0.100
GENERAL EMPLOYMENT	34	85	20	0.0100	0.400	200	0.0100	0.100
RESEARCH AND DEVELOPMENT	36	72	200	0.0100	0.300	200	0.0100	0.100
OFFICE/COMMERCIAL	OC-1	85	20	0.0100	0.400	200	0.0100	0.100
	OC-2	85	20	0.0100	0.400	200	0.0100	0.100
OFFICE/RESIDENTIAL	OR-2	85	20	0.0100	0.400	200	0.0100	0.100
MEDICAL	M-2	72	200	0.0100	0.300	200	0.0100	0.100
CIVIC CENTER	CC-2	85	20	0.0100	0.400	200	0.0100	0.100
RETAIL/SPECIALTY	RS-1	85	20	0.0100	0.400	200	0.0100	0.100
REGIONAL COMMERCIAL/OFFICE	RCO-2	85	20	0.0100	0.400	200	0.0100	0.100
3. OPEN SPACE								
NATURAL OPEN SPACE	41	1	300	0.0100	0.200	100	0.0100	0.100
LIMITED USE AREA	42	1	300	0.0100	0.200	100	0.0100	0.100
DEVELOPED OPEN SPACE	42	80	300	0.0100	0.200	100	0.0100	0.100
CULTURAL/INSTITUTIONAL	44	85	200	0.0100	0.300	200	0.0100	0.100
UTILITIES	45	72	200	0.0100	0.300	200	0.0100	0.100

3.2.3 Statistical Parameters

No statistical parameters were used for this hydrologic modeling.

3.2.4 Precipitation

Precipitation depths used in this study were determined based on the location of the study area and the isohyetal maps contained in the National Weather Service manual. Different values were considered for each of the major basins in the study area, however, the entire study area had the same results. Weighted average rainfall depths for the 2 yr, 6 hr; 2 yr, 24 hr; 100 yr, 6 hr; and 100 yr, 24 hr were then entered into the FMS for each major basin. The PREFRE model was run through the FMS and all of the other rainfall depths required by the HEC-1 models for the 2, 5, 10, 25, 50 and 100 year return periods were automatically calculated.

The PREFRE model calculates precipitation depth-duration-frequency values for the Western United States. It was developed by the National Weather Service and was later revised by the Bureau of Reclamation. For this project, a Primary Zone number of 7 and a Short Duration Zone number of 8 was used for all major basins. The rainfall depths used in the HEC-1 models are shown in Table 3.

Table 3 Depth - Duration - Frequency Values

Storm Duration	10 year depth [in]	100 year depth [in]
5 min	0.50	0.76
15 min	0.97	1.50
1 hour	1.61	2.55
2 hour	1.76	2.81
3 hour	1.86	2.98
6 hour	2.05	3.30

3.2.5 Gage Data

No gage data was available for this hydrologic modeling. Precipitation depths were determined using the method described in the previous section.

3.3 Calibration

The City of Scottsdale Stormwater Master Plan and Management Program HEC-1 models were verified to validate the reliability of the hydrologic modeling for use in this project. The verification objectives were undertaken as follows:

- All major basins were visually inspected to verify reasonableness of the hydrologic variables, drainage area boundaries, and flow paths.
- Topographic mapping was reviewed as provided by the City of Scottsdale to verify drainage area boundaries and flow paths.
- New topographic mapping was developed for the project for the City of Phoenix portion of the study area which affected Basins 07 and 03. The drainage area boundaries and flow paths in the new mapping area were then revised as necessary.

Other parameters were qualitatively reviewed for reasonableness based on the selection criteria and methodology employed by the FMS.

3.4 Special Problems / Solutions

During review and verification of the hydrologic modeling, it was decided that Basins 07 and 21 in the City of Scottsdale HEC-1 model should be combined into one major basin (Basin 07). This revision was made since Basin 07 drains through Basin 21 before leaving the study area.

3.5 Final Results / Computer Runs

Three models were necessary for supporting the STP Papago Watershed Study. Each of these represents a distinct set of HEC-1 files as described below.

Existing Conditions Hydrology - This modeling was based on the HEC-1 files in the City of Scottsdale's Stormwater Master Plan and Management Program and the hydrologic verification described in Section 3.3. There are seven (7) major basins: Basins 01, 02, 03, 04, 05, 06, and 07 as shown on the Existing Conditions Exhibit and in the 10yr, 6hr HEC-1 output files provided in the supporting calculations binder.

Alternative Conditions Hydrology - This modeling was designed to reflect the project alternatives considered for solving the drainage issues identified in the study area. Several iterations and variations were considered, eventually resulting in four independent models for the alternative conditions hydrology.

- Alternative A - Roosevelt Road Outfall
- Alternative B - City of Tempe Outfall
- Alternative C - Oak Street Outfall
- Alternative D - Osborn Road Outfall

The HEC-1 files for these alternatives were provided with the supporting calculations for the Alternative Analysis Report and are not included with the recommended plan submittal.

Recommended Plan Hydrology - Based on the alternative analysis, two of the alternatives were chosen for inclusion in the recommended plan:

- Oak Street Outfall
- Osborn Road Outfall

These alternative conditions HEC-1 models were combined into one model and refined based on the more detailed design associated with the preparation of the recommended plan. This included revising routing reaches, storm drain sizes, and storage basins to reflect as necessary the recommended plan. The result produced a model which was too large to compile in HEC-1 due to a limitation on the number of hanging hydrographs allowed. Therefore, the model was divided into two parts, A and B. Part A includes all basins which are affected hydraulically by the recommended plan. Part B includes the remaining basins which are hydraulically disconnected from the recommended plan but are a part of the recommended plan hydrology. The major basins and drainage boundaries are shown on the Recommended Plan Exhibit and in the 10yr, 6hr HEC-1 output files provided in the supporting calculations binder.

Rating curves for the proposed detention basins at Marriott's Brighton Gardens and Paiute Park were developed using STORMPlus for the outlet works. Increments of flow were entered into STORMPlus and water surface elevations were computed. Each water surface elevation was plotted vs. the flow rate to get a stage-discharge curve for HEC-1.

The Auto Park detention basin outlets into a proposed storm drain in 66th Street This storm drain runs north and joins the Oak Street outfall storm drain. The rating curve for the Auto Park basin was determined from the hydrograph ordinates for the outlet of the Auto Park in relationship to the hydrograph at the intersection of the 66th Street storm drain and the Oak Street storm drain (Table 4). The outflow

hydrograph from the Auto Park basin was incremented by 20 cfs (column 1). An example of how each data point of the rating curve was determined is as follows:

1. 20 cfs was selected for the Auto Park outflow (column 1).
2. The Auto Park hydrograph was examined to determine the approximate time (0248) on the rising limb for which the corresponding Q was 20 cfs (column 2).
3. The Auto Park hydrograph was examined to determine the approximate time (0402) on the receding limb for which the corresponding Q was 20 cfs (column 3).
4. At the time (0248) from Step 2, the Oak Street hydrograph was examined to determine the flow (40 cfs) (column 4).
5. The Oak Street hydrograph was examined to determine the flow (200 cfs) at the time (0402) from Step 3 (column 5).
6. The higher Q from columns 4 and 5 was selected as a conservative value of flow in the Oak Street storm drain. This value was entered into the Oak Street STORMPlus model. The resulting HGL elevation (1255.11) at Oak Street and 66th Street was then used as the starting tailwater elevation for the 66th Street STORMPlus model (column 6).
7. The 66th Street STORMPlus model was run to determine the HGL at the Auto Park outlet (column 7).
8. Steps 1-7 were repeated for each flow increment. Note that for the last two increments of Q it was clear that the rising limb Q would govern so steps 3-5 were not performed.
9. Column 7 vs. column 1 was plotted for the Auto Park stage-discharge curve.

Table 4 Rating Curve Calculation for Auto Park

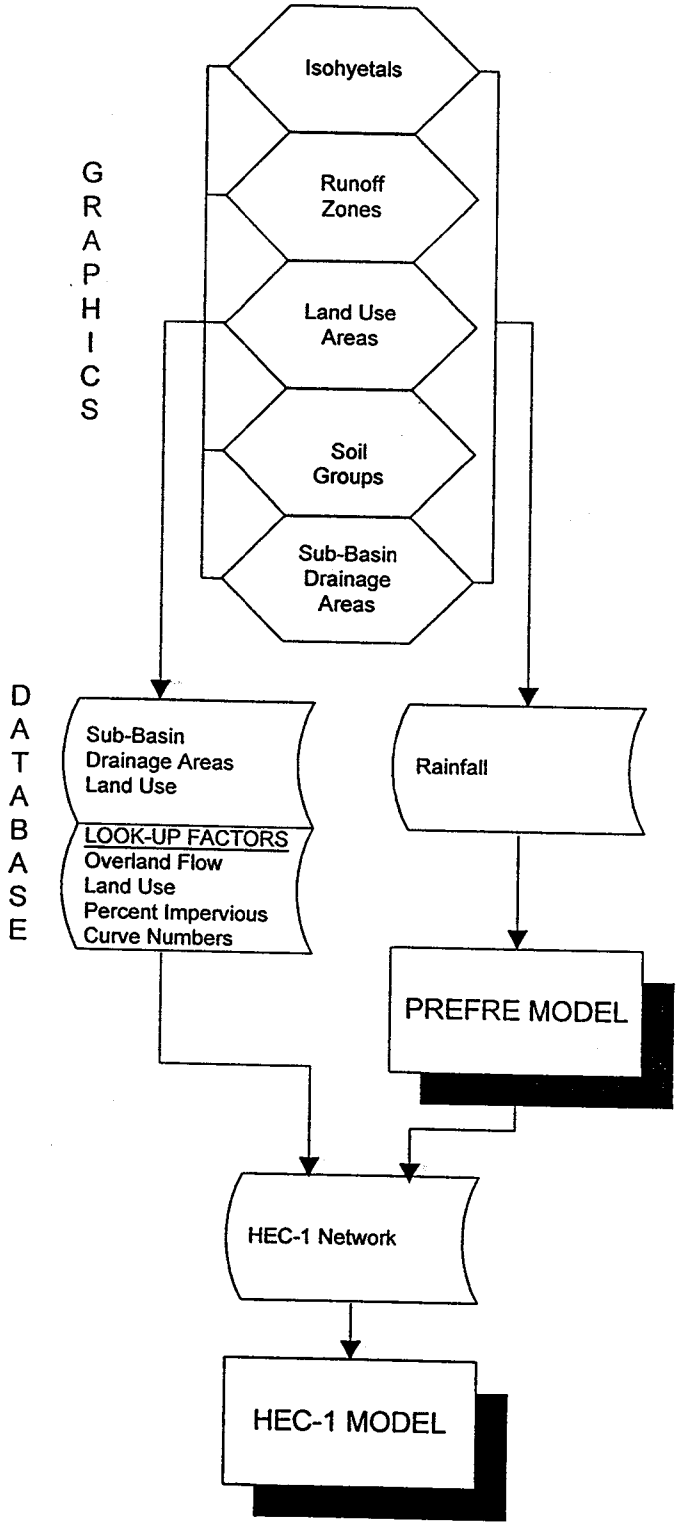
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Auto Park		**66th & Oak**			
Auto Park Q	Time rising limb	Time receding limb	Q_{rising}	$Q_{receding}$	HGL Oak	WS Auto Park
[cfs]	[hr]	[hr]	[cfs]	[cfs]	[ft]	[ft]
20	0248	0402	40	**200**	1255.11	1259.09
40	0254	0400	105	**210**	1255.17	1259.61
60	0301	0358	175	**230**	1255.29	1260.09
80	0302	0356	200	**270**	1255.52	1260.56
100	0303	0355	245	**280**	1255.58	1261.05
120	0305	0353	**310**	300	1255.74	1261.65
140	0308	0349	**422**	342	1256.3	1262.55
160	0312	0341	**484**	440	1256.6	1263.32
180	0318		**580**		1260.46	1266.89
190	0319		**600**		1262.62	1269.62

Denotes Q used in Oak Street STORMPlus model

The supporting calculations for the storage basins are included in this appendix.

3.6 Final Modeling Results on Diskettes

Digital copies of the 10 year, 6 hour event HEC-1 input files for the Existing Conditions Hydrology and the Recommended Plan Hydrology are provided in the supporting calculations binder.



HEC-1 Data Flow Linkage

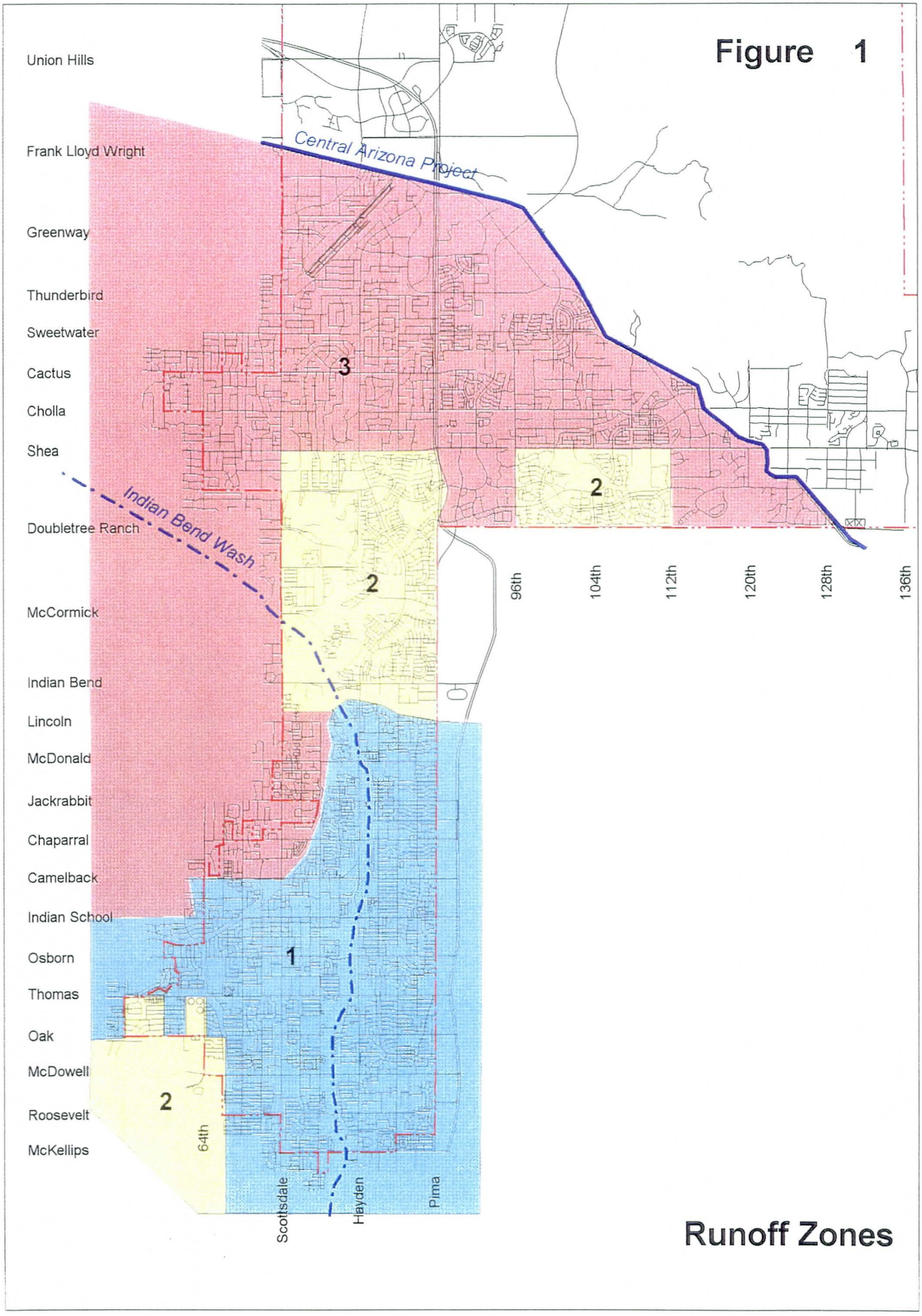


Figure 1
Union Hills
Frank Lloyd Wright
Greenway
Thunderbird
Sweetwater
Cactus
Cholla
Shea
Doubletree Ranch
McCormick
Indian Bend
Lincoln
McDonald
Jackrabbit
Chaparral
Camelback
Indian School
Osborn
Thomas
Oak
McDowell
Roosevelt
McKellips
Central Arizona Project
Indian Bend Wash
3
2
2
1
2
64th
Scottsdale
Hayden
Pima
96th
104th
112th
120th
128th
136th
Runoff Zones

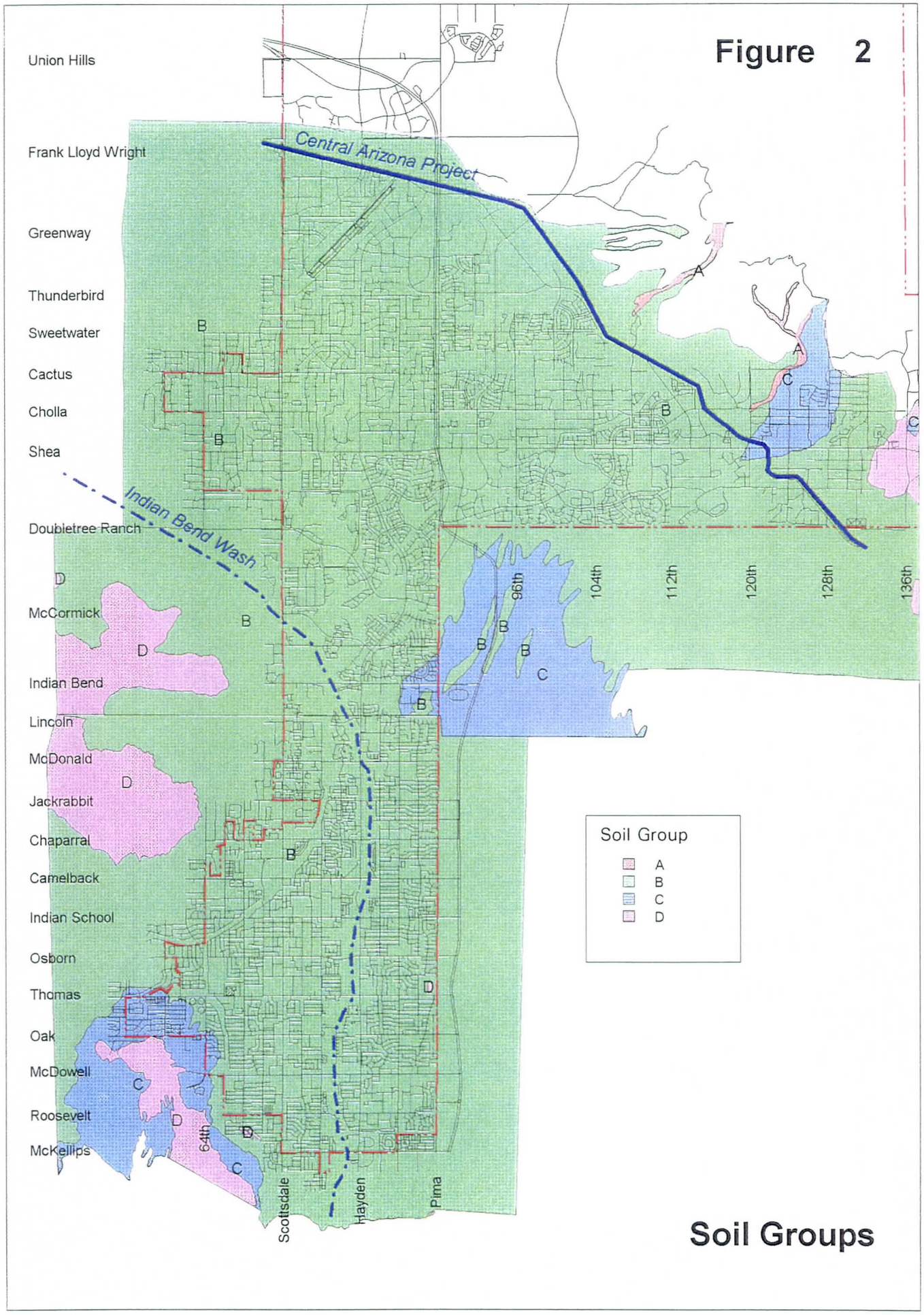
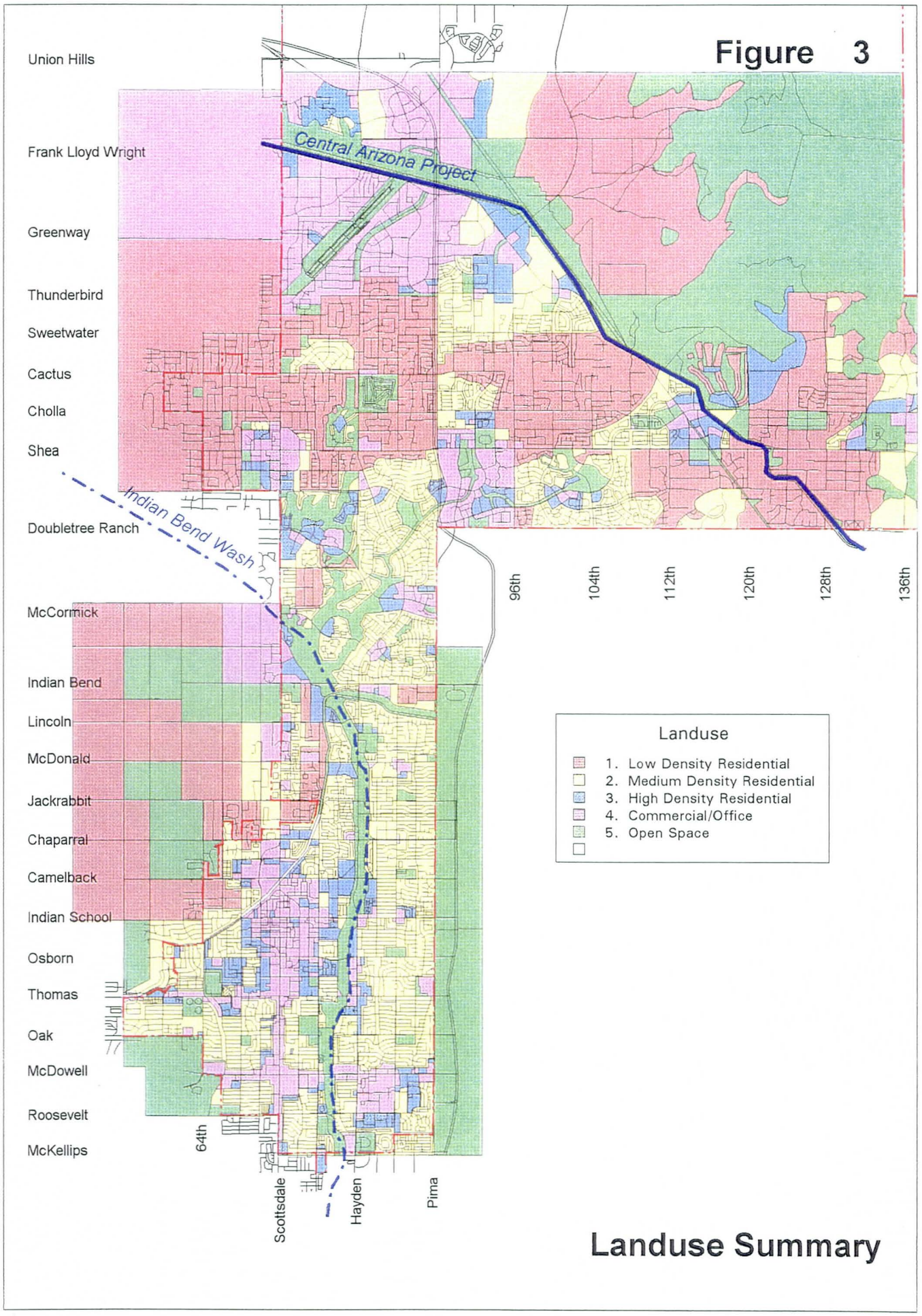


Figure 2
Union Hills
Frank Lloyd Wright
Greenway
Thunderbird
Sweetwater
Cactus
Cholla
Shea
Doubletree Ranch
McCormick
Indian Bend
Lincoln
McDonald
Jackrabbit
Chaparral
Camelback
Indian School
Osborn
Thomas
Oak
McDowell
Roosevelt
McKellips
Central Arizona Project
Indian Bend Wash
64th
Scottsdale
Hayden
Pima
96th
104th
112th
120th
128th
136th
Soil Group
A
B
C
D
Soil Groups

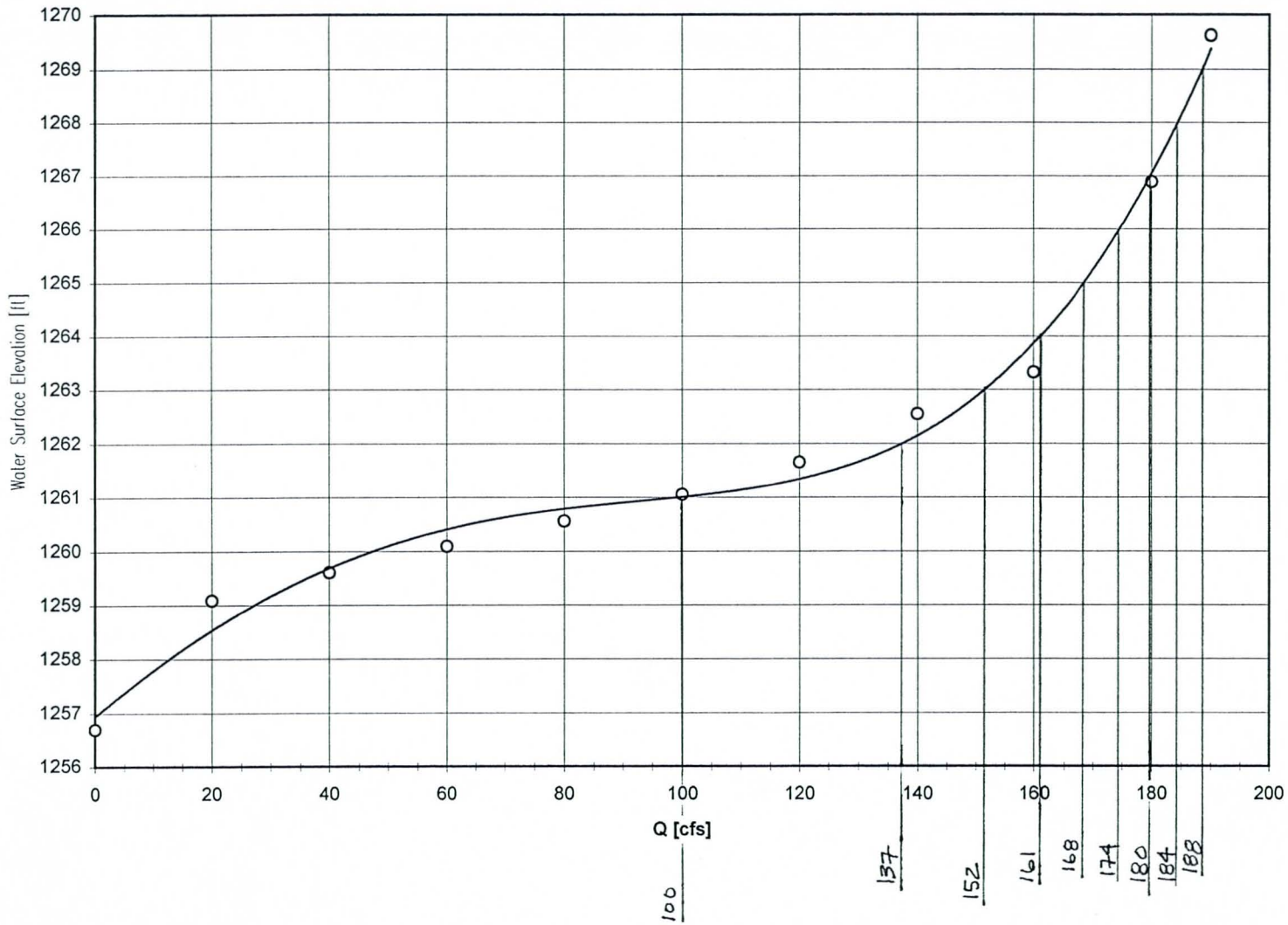


Landuse Summary

Auto Park

Elevation	Total Storage Area	Total Storage Area	Average Area	Δ Elev	Vol	Σ Vol	Q_{plp}	Q_{spl}	Total Qout
[ft]	[ft^2]	[acre]	[acre]	[ft]	[ac-ft]	[ac-ft]	[cfs]	[cfs]	[cfs]
1261	4,955	0.11				0	0	0	0
			0.13	1.0	0.13				
1262	6,534	0.15				0.13	47.5	0	47.5
			0.19	2.0	0.38				
1264	9,994	0.23				0.51	112	0	112
			0.46	1.0	0.46				
1265	30,237	0.69				0.97	135	0	135
			0.86	1.0	0.86				
1266	44,527	1.02				1.83	154	0	154
			1.05	1.0	1.05				
1267	47,045	1.08				2.88	176	0	176
			1.57	1.0	1.57				
1268	89,734	2.06				4.45	194	121.5	315.5
			2.66	1.0	2.66				
1269	141,570	3.25				7.11	211	344	555

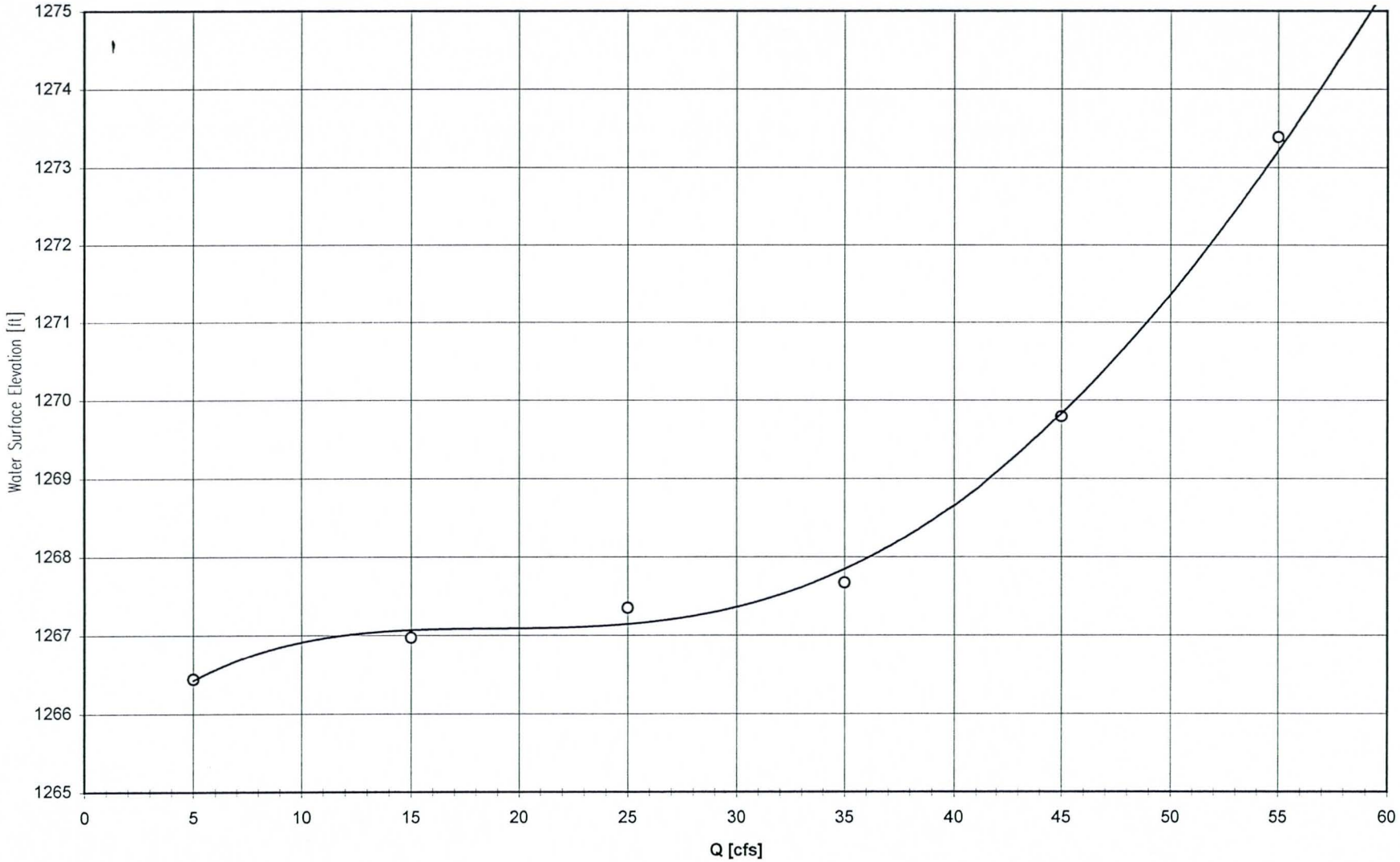
Auto Park
Stage-Discharge Curve



Marriott's Brighton Gardens

Elevation	Total Storage Area	Total Storage Area	Average Area	Δ Elev	Vol	Σ Vol	Q_{pip}	Q_{spl}	Total Qout
[ft]	[ft^2]	[acre]	[acre]	[ft]	[ac-ft]	[ac-ft]	[cfs]	[cfs]	[cfs]
1266	32,422	0.74				0	0	0	0
			0.78	1.0	0.78				
1267	35,802	0.82				0.78	11.8	0	11.8
			0.86	1.0	0.86				
1268	39,283	0.90				1.64	36	0	36
			1.00	1.0	1.00				
1269	48,110	1.10				2.65	41.6	0	41.6
			1.19	1.0	1.19				
1270	55,815	1.28				3.84	45.5	0	45.5
			1.37	1.0	1.37				
1271	63,638	1.46				5.21	47.8	0	47.8
			1.56	1.00	1.56				
1272	72,124	1.66				6.77	51.8	0	51.8
Overtopping									
1273							54.3	300	354.3

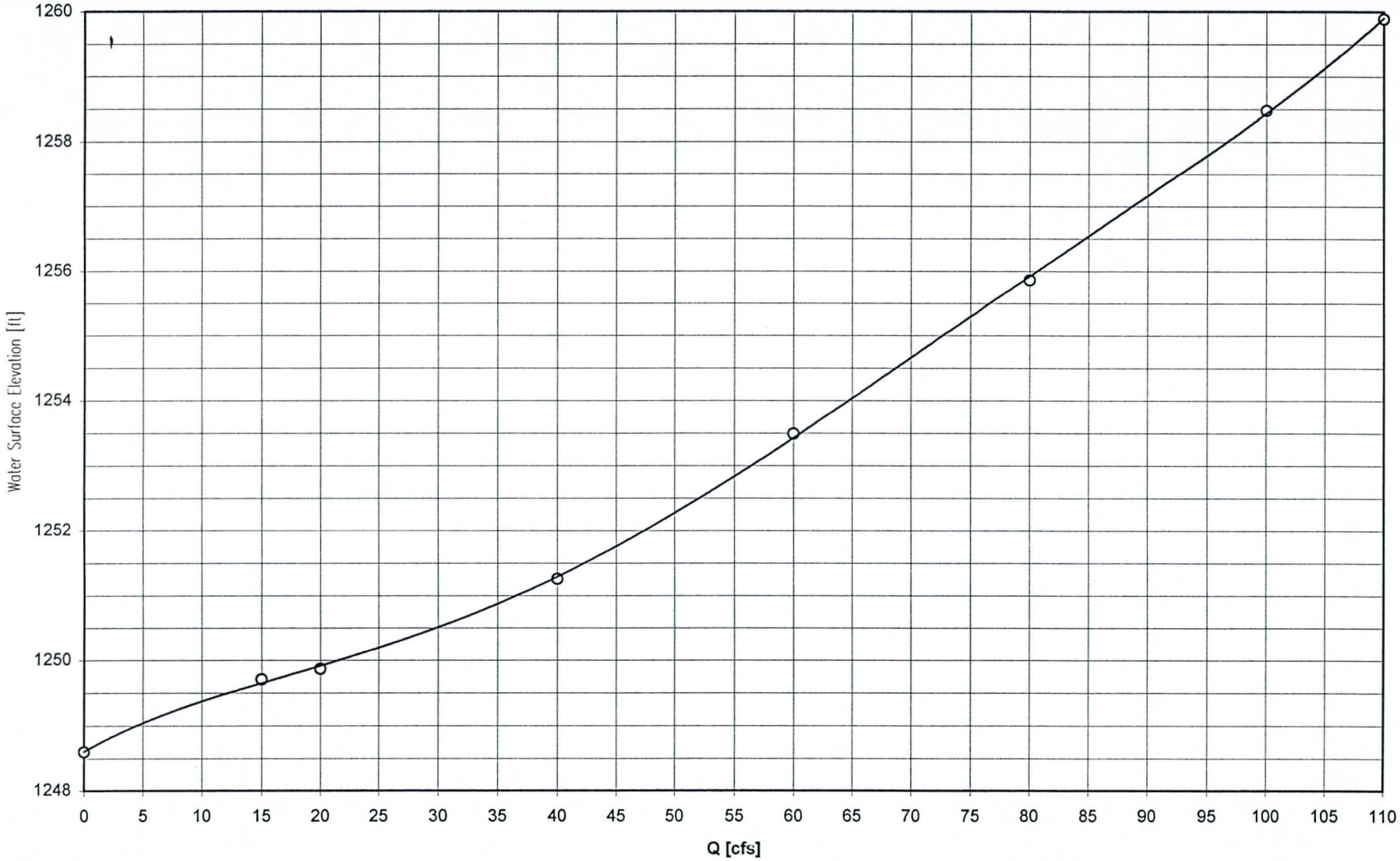
Marriott's Brighton Gardens
Stage-Discharge Curve



Paiute Park

Elevation	Pre-basin storage	Basin Storage	Total Storage Area	Total Storage Area	Average Area	Δ Elev	Vol	Σ Vol	Q_{plp}	Q_{spl}	Total Qout
[ft]	[ft^2]	[ft^2]	[ft^2]	[acre]	[acre]	[ft]	[ac-ft]	[ac-ft]	[cfs]	[cfs]	[cfs]
1249		5031	5,030	0.12				0	4.5	0	4.5
					0.64	1.0	0.64				
1250	17370	33346	50,720	1.16				0.64	22	0	22
					1.73	1.0	1.73				
1251	24206	75701	99,910	2.29				2.37	37	0	37
					2.77	1.0	2.77				
1252		141450	141,450	3.25				5.14	47	0	47
					3.26	1.0	3.26				
1253		142475	142,480	3.27				8.40	56	0	56
					3.33	1.0	3.33				
1254		147395	147,400	3.38				11.73	65	0	65
					3.39	1.0	3.39				
1255		147653	147,650	3.39				15.11	73	0	73
					3.42	1.0	3.42				
1256		150487	150,490	3.45				18.53	81	0	81
					3.51	1.0	3.51				
1257		155400	155,400	3.57				22.05	88	0	88
Overtopping											
1258									96	60	156
1259									104	170	274

Paiute Park
Stage-Discharge Curve



Oak St. Outfall

Concentration Point From	Concentration Point To	HEC-1 Conveyance	HEC-1 Size	STORMPlus Conveyance	STORMPlus Size	HEC-1 matches STORMPlus (✓)
070808	070610	Pipe	3.0	Pipe	3.0	✓
070610	070508	Pipe	3.0	Pipe	3.0	✓
070508	070010	Pipe	3.0	Pipe	3.0	✓
070010	070210	Pipe	3.0	Pipe	3.0	✓
070210	050005	Pipe	3.00	Pipe	3.00	✓
050005	030510	Pipe	3.0	Pipe	3.0	✓
030810	030510	Pipe	5.50	Pipe	5.50	✓
030510	030520	Pipe	4.8	Pipe	4.8	✓
Auto Park	030530	Pipe	5.50	Pipe	5.50	✓
030530	030520	Pipe	6.0	Pipe	6.0	✓
030520	040120	Pipe	7.50	Pipe	7.50	✓
040120	040130	Pipe	7.5	Pipe	7.5	✓
040130	040040	Pipe	7.50	Pipe	7.50	✓
040040	040050	Trap	14, 1:1	Trap	14, 1:1	✓
040050	040060	Trap	19, 1:1	Trap	19, 1:1	✓
040060	040070	Trap	19, 1:1	Trap	19, 1:1	✓

From Concentration Point	To Concentration Point	HEC-1 Conveyance	HEC-1 Size	STORMPlus Conveyance	STORMPlus Size	HEC-1 changed to match STORMPlus (✓)
07Qpip	070420	Pipe	3.0	Pipe	3.0	✓
070420	210005	Pipe	3.5	Pipe	3.5	✓
210005	050030	Pipe	5.0	Pipe	5.0	✓
050030	050305	Pipe	5.5	Pipe	5.5	✓
050305	050050	Trap	9, 1:1	Trap	9, 1:1	✓
050610	050620	Pipe	6.0	Pipe	6.0	✓
050620	050630	Pipe	7.00	Pipe	7.00	✓
050630	050640	Pipe	8.0	Pipe	8.0	✓
050640	051510	Pipe	9.50	Pipe	9.50	✓
051510	051520	Pipe	9.5	Pipe	9.5	✓
051520	001530	Pipe	9.50	Pipe	9.50	✓
051530	051540	Pipe	9.5	Pipe	9.5	✓
051540	051550	Pipe	9.50	Pipe	9.50	✓
051550	051560	Pipe	6.0	Pipe	6.0	✓
051560	051570	Pipe	7.0	Pipe	7.0	✓

APPENDIX A STUDY DOCUMENTATION ABSTRACT

STUDY DOCUMENTATION ABSTRACT	INITIAL STUDY		RESTUDY		LOMR		OTHER		PAGE 1

SECTION 1: GENERAL INFORMATION		
1A	COMMUNITY	Scottsdale, Tempe, Phoenix (STP) Papago
1B	COMMUNITY NUMBER	
1C	COUNTY	Maricopa
1D	STATE	Arizona
1E	DATE STUDY ACCEPTED	
1F	STUDY CONTRACTOR	Kimley-Horn & Associates, Inc.
	CONTACT(S)	Doug Plasencia, P.E. (Project Manager)
	ADDRESS	7600 N. 15th St., Suite 250
		Phoenix, AZ 85020
	PHONE	602-944-5500
	INTERNAL REF #	Job No. 091131.00
1G	TECH. REVIEWER (FEMA)	
	PHONE	
1H	FEMA REGIONAL REVIEWER	
	PHONE	
1I	STATE REVIEWER	
	PHONE	
1J	LOCAL REVIEWER	
	PHONE	
1K	RIVER OR STREAM NAME	
1L	REACH DESCRIPTION	
	(FIRM, PANEL & EPA REACH #)	EPA Reach # - N/A
1M	STUDY TYPE (RIVERINE, ALLUVIAL FAN, ETC)	Ponding Analysis
SECTION 2: MAPPING INFORMATION		
2A	USGS QUAD SHEET(S)	Tempe, AZ (1982); Paradise Valley, AZ (1982)
2B	MAPPING FOR HYDROLOGIC STUDY	
	TYPE/SOURCE	• Aerial topography/City of Scottsdale (COS) - flown by Michael Baker, Jr. Inc. • Aerial Topography/Flood Control District of Maricopa County (FCMCD) flown by Southwest Mapping Company
	SCALE	(COS) 1 ft contours; (FCMCD) 2 ft contours
	DATE	(COS) Sept. - Nov. 1993; (FCMCD) Dec. 1996
2C	MAPPING FOR HYDRAULIC STUDY	
	TYPE/SOURCE	• Aerial topography/City of Scottsdale (COS) - flown by Michael Baker, Jr. Inc. • Aerial Topography/Flood Control District of Maricopa County (FCMCD) flown by Southwest Mapping Company
	SCALE	(COS) 1 ft contours; (FCMCD) 2 ft contours
	DATE	(COS) Sept. - Nov. 1993; (FCMCD) Dec. 1996
	SUBCONTRACTOR (AERIAL)	(WP) Wood, Patel & Associates, Inc. - topography flown by Southwest Mapping Company, Inc.
	DATE OF AERIAL MAPPING	Dec. 1996

APPENDIX A STUDY DOCUMENTATION ABSTRACT

STUDY DOCUMENTATION ABSTRACT		
SECTION 3: HYDROLOGY		
3A	MODEL OR METHOD USED	Haestad Methods Program Integrator, HEC-1E, version 2.0
	(including vendor and version	vendor: Haestad Methods, Inc. 37 Brookside Rd., Waterbury, CT 06708
	description)	
3B	STORM DURATION	6 hr and 24 hr
3C	HYETOGRAPH TYPE	Weighted average rainfall depths as determined by the Arizona Department of Transportation Drainage Design Manual, Chapter 1 and Appendix B.
3D	FREQUENCIES DETERMINED	100-yr and 10-yr
3E	LIST OF GAGES USED IN FREQUENCY ANALYSIS OR CALIBRATION (Location, Years of Record, Gage Ownership)	None available in floodplain
3F	RAINFALL AMOUNTS AND REFERENCE	6-hr and 24-hr storms
3G	UNIQUE CONDITIONS AND PROBLEMS	Floodplain is related to ponding behind the Cross-Cut canal and the McDowell Rd. crossing of the canal. This study is a hydrologic routing through the pool of the floodplain.
3H	COORDINATION OF Q'S (agency, date, comments)	
SECTION 4: HYDRAULICS		
4A	MODEL OR METHOD USED (including vendor and version description)	
4B	REGIME	
4C	FREQUENCIES FOR WHICH PROFILES WERE COMPUTED	
4D	METHOD OF FLOODWAY CALCULATION	
4E	UNIQUE CONDITIONS AND PROBLEMS	

Appendix E - Hydraulic Analysis

Appendix E - Hydraulic Analysis

Purpose

This appendix describes the hydraulic analysis performed for the recommended plan. The analysis is based on the preliminary plans and was prepared for use in evaluating the hydraulic performance of the recommended plan. Revised hydraulic calculations should be prepared to support the final design and construction documents.

Methodology

The recommended plan hydraulics were discussed with the District staff prior to preliminary design to develop a consensus on the details of the design. Based on these decisions, the hydraulics were designed using the StormPLUS software and the following design standards.

Design Standards

Storm Drain Criteria

Max Velocity	Design to avoid excessive energy loss and erosive velocities (20 ft/s)
Min Velocity	2 ft/s at 1/2 of Design Q (required) 5 ft/s at Design Q (recommended)
Froude Number	Less than 0.86 for the design event.
Minimum Slope	0.1% (required) 0.5% (recommended)
Minimum Diameter	15" (laterals); 24" (mains)
Pipe Size	Pipe sizes increase in the downstream direction.
Pipe Material	Rubber Gasketed Reinforced Concrete Pipe (RGRCP)
Mannings 'n' Value	n = .013

Hydraulic Grade Line (HGL) Calculations

Design Event Rule	The storm drain is designed for pressure flow conditions, where the HGL is at least 0.5 foot below the gutter elevation for the design event.
Check Storm Rule	The storm drain should be designed where runoff can be carried in the storm drain and by surcharge in the street. Street overflows should be limited to 100 cfs at 10 ft/sec for the check storm event.
Pipes into Manholes	Match inverts in storm drain, where practical, so the manhole bottom supports the jet issuing from the upstream pipe.

The StormPLUS software from Streamline Technologies was used to design the storm drain and determine the HGL. The primary advantages for it's use include:

- It is a nationally recognized software package
- It uses the momentum equation to calculate junction losses
- Results can be exported to Plan and Profile sheets

Tailwater Conditions

The starting tailwater for Indian Bend Wash (IBW) at Oak Street and Osborn Road was set at the soffitt of the storm drain for both outfalls.

A 100 year tailwater in IBW at the time to peak for the Oak Street storm drain was provided by the District. This tailwater will be used to demonstrate the performance of the Oak Street Outfall and the affects on the Hy-View neighborhood floodplain for submittal to FEMA.

Based on discussions with the Steering Committee, a starting tailwater was set for the Osborn Road Outfall at the connection to existing pipe since the existing pipe would not generate a reasonable tailwater for a 10 year event at this location. This was assumed to be the maximum allowable water surface of 0.5 foot below the gutter elevation. This tailwater was then used to design the proposed Osborn Road storm drain for a 10 year event.

This design results in a hydraulic grade line which exceeds the ground elevations in the vicinity of Miller Road. This is because the road elevations are slightly lower just west of the connection to the existing storm drain; and because the highest possible starting tailwater assumption was used and a gravity sewer main needed to be avoided at this location. This departure from the design standards is considered unavoidable. The higher HGL will not cause overtopping of the system since there is no access to the proposed storm drain at this location. If the District decides to extend the 10 year storm drain to IBW, it should be sized to reduce the HGL to meet design standards.

Maintenance and Access Requirements, Maximum Spacing

30" or smaller -	300 ft
30" to 48" -	400 ft
48" and larger -	500 ft
60" and larger -	660 ft
Box Culverts -	660 ft

Inlet Structures

A headwall, wingwalls, protection barrier or trash rack, fencing and paved apron should be used at all inlets. Interception of flow from a natural watercourse directly into a storm drain system should be avoided where practical.

Outlet Structures

Fencing, a protection barrier or trash rack, headwall, wingwalls, and a concrete or grouted rock apron should be used at all outlets. Velocity of flow at the outlet should be designed to avoid erosion and to reflect the velocity in the receiving waters.

Final Results

Copies of the StormPLUS output files for the design event are provided in this appendix. The storm drain layout and the hydraulic grade line for the design event are also shown on the preliminary plans to demonstrate performance. Copies of the StormPLUS input files are on the diskettes in the supporting calculations binder.

StormPLUS Output

Oak Street Main Line (oak6100.out)

```
STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version □□□□□
Serial Number □□□□□□□□

Oct  2, 1997  16:54:15

Input file : oak6100.dat
Output file: oak6100.out
```

INPUT FILE LISTING

```
T1 STP Papago - 091131.00 - Recommended Plan Analysis
T2 Oak Street Storm Drain
T3 6 HR 10 YR Storm in Mainline - 6 hr 100 YR in 66th & 64th St.
SO   1000.00 206.50  1                          211.10
BX   1000.00 206.50  2
R    1154.02 207.12  2      .013
R    1281.05 207.63  2      .013                                  55.98
JX   1501.52 208.51  2 13   .013    23.         210.51           33.97
R    1516.60 208.57  2      .013                                                1
R    1565.56 208.76  2      .013                                  56.11
R    2750.00 213.50  2      .013                                                2
JX   2800.00 213.70  2 10   .013   174.         216.00           90.00
TS   2835.00 217.77  3      .013
R    2908.65 217.84  3      .013                                         5.00 1
R    3053.65 217.99  3      .013                                         5.00
R    3250.00 218.18  3      .013
R    4100.00 223.28  3      .013                                                2
JX   4152.79 223.60  3 10   .013    99.         223.60           90.00
R    4250.00 224.18  3      .013                                         5.00 1
TS   4300.00 224.38  6      .013
R    4315.03 224.44  6      .013                                         5.00
R    5520.43 229.26  6      .013                                         5.00 2
R    5736.03 230.12  6      .013                                         5.00 1
R    6750.00 236.20  6      .013                                                2
TS   6800.00 236.98  7      .013
R    7300.00 244.82  7      .013                                                1
TS   7350.00 245.33  3      .013
R    7418.13 246.03  3      .013                                         5.00
R    7802.69 249.98  3      .013                                         5.00 1
R    7950.00 251.49  3      .013
R    8100.00 253.03  3      .013                                                1
JX   8122.54 253.26  3  5   .013   217.         253.26           79.56
JX   8179.33 253.84  3 11   .013    87.         254.09           90.00
BE   8179.33 253.84  4
TS   8229.33 254.35  9      .013
R    8230.00 254.36  9      .013                                         5.00
R    8343.99 255.95  9      .013                                         5.00
R    9214.43 268.08  9      .013                                         5.00 2
R    9302.68 269.32  9      .013                                         5.00
R    9400.00 270.67  9      .013                                                1
JX   9411.76 270.84  9 8 11 .013   140.     63.  270.83 271.21 90.00 90.00
R    9502.68 272.11  9      .013                                         5.00 1
R    9574.21 273.09 12      .013                                         5.00
R   10200.00 281.83 12      .013                                                2
R   10850.00 292.89 12      .013                                                2
JX  10860.00 293.06 12 13   .013    20.         293.56           90.00
R   11950.00 301.78 12      .013                                         5.00 2
R   12083.36 302.85 12      .013                                         5.00 1
JX  12100.00 302.98 12 13   .013    17.         303.48           90.00
R   12132.78 303.24 12      .013
R   13025.00 306.18 12      .013                                        45.00 3
R   13095.00 306.41 12      .013
SH                  12
```

SP

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
CD	1	3	0	.00	4.50	19.75	.00	.00	.00										
CD	2	3	1	.75	4.50	19.75	.00	.00	.00										
CD	3	3	1	.75	4.50	14.75	.00	.00	.00										
CD	4	3	0	.00	4.50	14.75	.00	.00	.00										
CD	5	3	0	.00	4.50	7.00	.00	.00	.00										
CD	6	4			7.50														
CD	7	4			6.25														
CD	8	4			5.50														
CD	9	4			4.75														
CD	10	4			4.50														
CD	11	4			4.00														
CD	12	4			3.00														
CD	13	4			2.00														

WATER SURFACE PROFILE - TITLE CARD LISTING

```
HEADING LINE NO 1 IS -
                        STP Papago - 091131.00 - Recommended Plan Analysis
HEADING LINE NO 2 IS -
                        Oak Street Storm Drain
HEADING LINE NO 3 IS -
```

6 HR 10 YR Storm in Mainline - 6 hr 100 YR in 66th & 64th St.

WATER SURFACE PROFILE - ELEMENT CARD LISTING

```
ELEMENT NO   1 IS A SYSTEM OUTLET          *        *        *
                U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                             1000.00  206.50    1                                       211.10
ELEMENT NO   2 IS A BRIDGE EXIT                          *
                U/S DATA   STATION    INVERT  SECT
                             1000.00  206.50    2
ELEMENT NO   3 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             1154.02  207.12    2             .013                                  .00    .00     .00      0
ELEMENT NO   4 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             1281.05  207.63    2             .013                                  .00  55.98     .00      0
ELEMENT NO   5 IS A JUNCTION       *        *        *        *        *                  *        *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             1501.52  208.51    2    13     0   .013   23.0      .0   210.51     .00  33.97     .00
ELEMENT NO   6 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             1516.60  208.57    2             .013                                  .00    .00     .00      1
ELEMENT NO   7 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             1565.56  208.76    2             .013                                  .00  56.11     .00      0
ELEMENT NO   8 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             2750.00  213.50    2             .013                                  .00    .00     .00      2
ELEMENT NO   9 IS A JUNCTION       *        *        *        *        *                  *        *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             2800.00  213.70    2    10     0   .013  174.0      .0   216.00     .00  90.00     .00
ELEMENT NO  10 IS A TRANSITION     *        *        *
                U/S DATA   STATION    INVERT  SECT              N
                             2835.00  217.77    3             .013
ELEMENT NO  11 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             2908.65  217.84    3             .013                                  .00    .00    5.00      1
ELEMENT NO  12 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             3053.65  217.99    3             .013                                  .00    .00    5.00      0
ELEMENT NO  13 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             3250.00  218.18    3             .013                                  .00    .00     .00      0
ELEMENT NO  14 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             4100.00  223.28    3             .013                                  .00    .00     .00      2
ELEMENT NO  15 IS A JUNCTION       *        *        *        *        *                  *        *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             4152.79  223.60    3    10     0   .013   99.0      .0   223.60     .00  90.00     .00
ELEMENT NO  16 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             4250.00  224.18    3             .013                                  .00    .00    5.00      1
ELEMENT NO  17 IS A TRANSITION     *        *        *
                U/S DATA   STATION    INVERT  SECT              N
                             4300.00  224.38    6             .013
ELEMENT NO  18 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             4315.03  224.44    6             .013                                  .00    .00    5.00      0
ELEMENT NO  19 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             5520.43  229.26    6             .013                                  .00    .00    5.00      2
ELEMENT NO  20 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             5736.03  230.12    6             .013                                  .00    .00    5.00      1
ELEMENT NO  21 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             6750.00  236.20    6             .013                                  .00    .00     .00      2
ELEMENT NO  22 IS A TRANSITION     *        *        *
                U/S DATA   STATION    INVERT  SECT              N
                             6800.00  236.98    7             .013
ELEMENT NO  23 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             7300.00  244.82    7             .013                                  .00    .00     .00      1
ELEMENT NO  24 IS A TRANSITION     *        *        *
                U/S DATA   STATION    INVERT  SECT              N
                             7350.00  245.33    3             .013
ELEMENT NO  25 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             7418.13  246.03    3             .013                                  .00    .00    5.00      0
ELEMENT NO  26 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             7802.69  249.98    3             .013                                  .00    .00    5.00      1
ELEMENT NO  27 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             7950.00  251.49    3             .013                                  .00    .00     .00      0
ELEMENT NO  28 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             8100.00  253.03    3             .013                                  .00    .00     .00      1
ELEMENT NO  29 IS A JUNCTION       *        *        *        *        *                  *        *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             8122.54  253.26    3     5     0   .013  217.0      .0   253.26     .00  79.56     .00
ELEMENT NO  30 IS A JUNCTION       *        *        *        *        *                  *        *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                             8179.33  253.84    3    11     0   .013   87.0      .0   254.09     .00  90.00     .00
ELEMENT NO  31 IS A BRIDGE ENTRANCE                      *
                U/S DATA   STATION    INVERT  SECT             FP
                             8179.33  253.84    4          1.000
ELEMENT NO  32 IS A TRANSITION     *        *        *
                U/S DATA   STATION    INVERT  SECT              N
                             8229.33  254.35    9             .013
ELEMENT NO  33 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             8230.00  254.36    9             .013                                  .00    .00    5.00      0
ELEMENT NO  34 IS A REACH          *        *        *
                U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                             8343.99  255.95    9             .013                                  .00    .00    5.00      0
```

```
 ELEMENT NO  35 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                            9214.43   268.08    9                .013                                   .00    .00    5.00      2
 ELEMENT NO  36 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                            9302.68   269.32    9                .013                                   .00    .00    5.00      0
 ELEMENT NO  37 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                            9400.00   270.67    9                .013                                   .00    .00     .00      1
 ELEMENT NO  38 IS A JUNCTION           *         *     *     *         *                    *          *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                            9411.76   270.84    9     8    11   .013   140.0     63.0   270.83   271.21  90.00   90.00
 ELEMENT NO  39 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                            9502.68   272.11    9                .013                                   .00    .00    5.00      1
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
 ELEMENT NO  40 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                            9574.21   273.09   12                .013                                   .00    .00    5.00      0
 ELEMENT NO  41 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           10200.00   281.83   12                .013                                   .00    .00     .00      2
 ELEMENT NO  42 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           10850.00   292.89   12                .013                                   .00    .00     .00      2
 ELEMENT NO  43 IS A JUNCTION           *         *     *     *         *                    *          *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                           10860.00   293.06   12    13     0   .013    20.0       .0   293.56      .00  90.00     .00
 ELEMENT NO  44 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           11950.00   301.78   12                .013                                   .00    .00    5.00      2
 ELEMENT NO  45 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           12083.36   302.85   12                .013                                   .00    .00    5.00      1
 ELEMENT NO  46 IS A JUNCTION           *         *     *     *         *                    *          *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                           12100.00   302.98   12    13     0   .013    17.0       .0   303.48      .00  90.00     .00
 ELEMENT NO  47 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           12132.78   303.24   12                .013                                   .00    .00     .00      0
 ELEMENT NO  48 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           13025.00   306.18   12                .013                                   .00    .00   45.00      3
 ELEMENT NO  49 IS A REACH              *         *     *
                U/S DATA   STATION    INVERT  SECT                N                                RADIUS  ANGLE  ANG PT  MAN H
                           13095.00   306.41   12                .013                                   .00    .00     .00      0
 ELEMENT NO  50 IS A SYSTEM HEADWORKS                   *                         *
                U/S DATA   STATION    INVERT  SECT                                          W S ELEV
                           13095.00   306.41   12                                                .00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
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WATER SURFACE PROFILE LISTING
STP Papago - 091131.00 - Recommended Plan Analysis
Oak Street Storm Drain
6 HR 10 YR Storm in Mainline - 6 hr 100 YR in 66th & 64th St.

STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
1000.00	206.50	4.60	211.10	867.0	9.78	1.49	212.59	.00	3.91		4.50	19.75	.00	0	.00
BRIDGE EXIT													.00		
1000.00	206.50	4.60	211.10	867.0	10.20	1.62	212.72	.00	4.01		4.50	19.75	.00	1	.75
154.02	.00403					.00456	.70			3.82			.00		
1154.02	207.12	4.68	211.80	867.0	10.20	1.62	213.42	.00	4.01		4.50	19.75	.00	1	.75
127.03	.00402					.00456	.58			3.82			.00		
1281.05	207.63	5.01	212.64	867.0	10.20	1.62	214.25	.00	4.01		4.50	19.75	.00	1	.75
JUNCT STR	.00399					.00445	.98						.00		
1501.52	208.51	5.23	213.74	844.0	9.93	1.53	215.27	.00	3.94		4.50	19.75	.00	1	.75
15.08	.00398					.00433	.07			3.76			.00		
1516.60	208.57	5.31	213.88	844.0	9.93	1.53	215.41	.00	3.94		4.50	19.75	.00	1	.75
48.96	.00388					.00433	.21			3.79			.00		
1565.56	208.76	5.57	214.33	844.0	9.93	1.53	215.86	.00	3.94		4.50	19.75	.00	1	.75
1184.44	.00400					.00433	5.12			3.75			.00		
2750.00	213.50	6.11	219.61	844.0	9.93	1.53	221.14	.00	3.94		4.50	19.75	.00	1	.75
JUNCT STR	.00400					.00353	.18						.00		
2800.00	213.70	7.22	220.92	670.0	7.88	.97	221.88	.00	3.38		4.50	19.75	.00	1	.75
TRANS STR	.11629												.00		
2835.00	217.77	4.14	221.91	670.0	11.55	2.07	223.99	.00	4.14		4.50	14.75	.00	1	.75
4.41	.00095					.00409	.02			4.50			.00		
2839.41	217.77	4.35	222.12	670.0	11.01	1.88	224.00	.00	4.14		4.50	14.75	.00	1	.75
9.90	.00095					.00367	.04			4.50			.00		
2849.31	217.78	4.50	222.28	670.0	10.64	1.76	224.04	.00	4.14		4.50	14.75	.00	1	.75
59.34	.00095					.00351	.21			4.50			.00		
2908.65	217.84	4.50	222.34	670.0	10.64	1.76	224.10	.00	4.14		4.50	14.75	.00	1	.75
145.00	.00103					.00351	.51			4.50			.00		
3053.65	217.99	4.50	222.49	670.0	10.64	1.76	224.25	.00	4.14		4.50	14.75	.00	1	.75
185.16	.00097					.00351	.65			4.50			.00		
3238.81	218.17	4.50	222.67	670.0	10.64	1.76	224.43	.00	4.14		4.50	14.75	.00	1	.75
HYDRAULIC JUMP													.00		
3238.81	218.17	3.81	221.98	670.0	12.57	2.45	224.43	.00	4.14		4.50	14.75	.00	1	.75
11.19	.00097					.00571	.06			4.50			.00		
3250.00	218.18	3.66	221.85	670.0	13.06	2.65	224.49	.00	4.14		4.50	14.75	.00	1	.75
589.08	.00600					.00600	3.54			3.66			.00		
3839.08	221.71	3.66	225.38	670.0	13.06	2.65	228.03	.00	4.14		4.50	14.75	.00	1	.75
190.81	.00600					.00579	1.11			3.66			.00		
4029.88	222.86	3.77	226.63	670.0	12.71	2.51	229.13	.00	4.14		4.50	14.75	.00	1	.75
59.44	.00600					.00526	.31			3.66			.00		
4089.32	223.22	3.95	227.17	670.0	12.12	2.28	229.45	.00	4.14		4.50	14.75	.00	1	.75
10.68	.00600					.00464	.05			3.66			.00		
4100.00	223.28	4.14	227.42	670.0	11.55	2.07	229.50	.00	4.14		4.50	14.75	.00	1	.75
JUNCT STR	.00606					.00430	.23						.00		
4152.79	223.60	5.35	228.95	571.0	9.14	1.30	230.25	.00	3.72		4.50	14.75	.00	1	.75
5.56	.00597					.00424	.02			3.26			.00		

4158.35	223.63	5.34	228.98	571.0	9.14	1.30	230.27	.00	3.72		4.50	14.75	.00	1	.75
HYDRAULIC JUMP													.00		
4158.35	223.63	2.25	225.88	571.0	18.14	5.11	230.99	.00	3.72		4.50	14.75	.00	1	.75
28.33	.00597					.01750	.50			3.26			.00		
4186.68	223.80	2.16	225.97	571.0	18.84	5.52	231.48	.00	3.72		4.50	14.75	.00	1	.75
32.67	.00597					.01977	.65			3.26			.00		
4219.35	224.00	2.06	226.06	571.0	19.76	6.07	232.13	.00	3.72		4.50	14.75	.00	1	.75
30.65	.00597					.02263	.69			3.26			.00		
4250.00	224.18	1.97	226.15	571.0	20.73	6.68	232.82	.00	3.72		4.50	14.75	.00	1	.75
TRANS STR	.00400					.01484	.74						.00		
4300.00	224.38	6.15	230.53	571.0	14.72	3.37	233.90	.00	6.15		7.50	.00	.00	0	.00
15.03	.00399					.00535	.08			7.50			.00		
4315.03	224.44	6.39	230.83	571.0	14.23	3.15	233.98	.00	6.15		7.50	.00	.00	0	.00
114.10	.00400					.00501	.57			7.50			.00		
4429.13	224.90	6.80	231.69	571.0	13.57	2.86	234.55	.00	6.15		7.50	.00	.00	0	.00
391.99	.00400					.00500	1.96			7.50			.00		
4821.12	226.46	7.45	233.91	571.0	12.94	2.60	236.51	.00	6.15		7.50	.00	.00	0	.00
34.19	.00400					.00532	.18			7.50			.00		
4855.31	226.60	7.50	234.10	571.0	12.92	2.60	236.70	.00	6.15		7.50	.00	.00	0	.00
665.11	.00400					.00550	3.66			7.50			.00		
5520.43	229.26	8.66	237.92	571.0	12.92	2.60	240.52	.00	6.15		7.50	.00	.00	0	.00
.00	.00400					.00553	.00			7.50			.00		
5520.43	229.26	8.66	237.92	571.0	12.92	2.60	240.52	.00	6.15		7.50	.00	.00	0	.00
215.60	.00399					.00553	1.19			7.50			.00		
5736.03	230.12	9.17	239.29	571.0	12.92	2.60	241.88	.00	6.15		7.50	.00	.00	0	.00
1013.97	.00600					.00553	5.61			5.90			.00		
6750.00	236.20	8.95	245.15	571.0	12.92	2.60	247.75	.00	6.15		7.50	.00	.00	0	.00
TRANS STR	.01560												.00		
6800.00	236.98	5.02	242.00	571.0	21.62	7.26	249.26	.00	5.94		6.25	.00	.00	0	.00
300.08	.01568					.01467	4.40			4.94			.00		
7100.08	241.69	5.22	246.91	571.0	20.85	6.76	253.67	.00	5.94		6.25	.00	.00	0	.00
147.68	.01568					.01361	2.01			4.94			.00		
7247.76	244.00	5.53	249.53	571.0	19.88	6.14	255.68	.00	5.94		6.25	.00	.00	0	.00
52.24	.01568					.01287	.67			4.94			.00		
7300.00	244.82	5.94	250.76	571.0	18.96	5.58	256.35	.00	5.94		6.25	.00	.00	0	.00
TRANS STR	.01020					.00846	.42						.00		
7350.00	245.33	10.57	255.90	571.0	9.14	1.30	257.20	.00	3.72		4.50	14.75	.00	1	.75
68.13	.01027					.00424	.29			2.67			.00		
7418.13	246.03	10.18	256.21	571.0	9.14	1.30	257.51	.00	3.72		4.50	14.75	.00	1	.75
384.56	.01027					.00424	1.63			2.67			.00		
7802.69	249.98	7.95	257.93	571.0	9.14	1.30	259.23	.00	3.72		4.50	14.75	.00	1	.75
147.31	.01025					.00424	.63			2.67			.00		
7950.00	251.49	7.07	258.56	571.0	9.14	1.30	259.85	.00	3.72		4.50	14.75	.00	1	.75
150.00	.01027					.00424	.64			2.67			.00		
8100.00	253.03	6.23	259.26	571.0	9.14	1.30	260.56	.00	3.72		4.50	14.75	.00	1	.75
JUNCT STR	.01020					.00294	.07						.00		
8122.54	253.26	7.53	260.79	354.0	5.66	.50	261.28	.00	2.71		4.50	14.75	.00	1	.75
JUNCT STR	.01021					.00128	.07						.00		
8179.33	253.84	7.45	261.29	267.0	4.27	.28	261.57	.00	2.24		4.50	14.75	.00	1	.75
BRIDGE ENTRANCE													.00		
8179.33	253.84	7.49	261.33	267.0	4.04	.25	261.59	.00	2.17		4.50	14.75	.00	0	.00
TRANS STR	.01020												.00		
8229.33	254.35	3.87	258.22	267.0	17.26	4.63	262.85	.00	4.45		4.75	.00	.00	0	.00
.67	.01492					.01395	.01			3.74			.00		
8230.00	254.36	3.87	258.23	267.0	17.26	4.63	262.86	.00	4.45		4.75	.00	.00	0	.00
113.99	.01395					.01394	1.59			3.87			.00		
8343.99	255.95	3.87	259.82	267.0	17.25	4.63	264.45	.00	4.45		4.75	.00	.00	0	.00
504.04	.01393					.01394	7.03			3.87			.00		
8848.03	262.97	3.87	266.85	267.0	17.25	4.63	271.47	.00	4.45		4.75	.00	.00	0	.00
366.40	.01393					.01364	5.00			3.87			.00		
9214.43	268.08	3.97	272.05	267.0	16.87	4.42	276.47	.00	4.45		4.75	.00	.00	0	.00
88.25	.01405					.01310	1.16			3.86			.00		
9302.68	269.32	4.07	273.39	267.0	16.52	4.24	277.63	.00	4.45		4.75	.00	.00	0	.00
47.71	.01387					.01269	.61			3.88			.00		
9350.39	269.98	4.16	274.14	267.0	16.24	4.10	278.24	.00	4.45		4.75	.00	.00	0	.00
49.61	.01387					.01223	.61			3.88			.00		
9400.00	270.67	4.45	275.12	267.0	15.48	3.72	278.84	.00	4.45		4.75	.00	.00	0	.00
JUNCT STR	.01445					.00637	.07						.00		
9411.76	270.84	11.29	282.13	64.0	3.61	.20	282.33	.00	2.29		4.75	.00	.00	0	.00
90.92	.01397					.00079	.07			1.58			.00		
9502.68	272.11	10.11	282.22	64.0	9.05	1.27	283.49	.00	2.57		3.00	.00	.00	0	.00
71.53	.01370					.00921	.66			2.07			.00		
9574.21	273.09	9.80	282.89	64.0	9.05	1.27	284.17	.00	2.57		3.00	.00	.00	0	.00
625.79	.01397					.00921	5.76			2.05			.00		
10200.00	281.83	6.95	288.78	64.0	9.05	1.27	290.06	.00	2.57		3.00	.00	.00	0	.00
490.07	.01702					.00921	4.51			1.91			.00		
10690.07	290.17	3.22	293.39	64.0	9.05	1.27	294.66	.00	2.57		3.00	.00	.00	0	.00
HYDRAULIC JUMP													.00		
10690.07	290.17	1.96	292.13	64.0	13.09	2.66	294.79	.00	2.57		3.00	.00	.00	0	.00
74.42	.01702					.01517	1.13			1.91			.00		
10764.49	291.44	2.03	293.46	64.0	12.60	2.47	295.93	.00	2.57		3.00	.00	.00	0	.00
40.61	.01702					.01368	.56			1.91			.00		
10805.10	292.13	2.11	294.24	64.0	12.02	2.24	296.48	.00	2.57		3.00	.00	.00	0	.00
22.29	.01702					.01221	.27			1.91			.00		
10827.39	292.51	2.21	294.72	64.0	11.46	2.04	296.76	.00	2.57		3.00	.00	.00	0	.00
13.10	.01702					.01095	.14			1.91			.00		
10840.49	292.73	2.32	295.05	64.0	10.92	1.85	296.90	.00	2.57		3.00	.00	.00	0	.00
7.22	.01702					.00987	.07			1.91			.00		
10847.71	292.85	2.43	295.29	64.0	10.42	1.69	296.97	.00	2.57		3.00	.00	.00	0	.00
2.29	.01702					.00897	.02			1.91			.00		
10850.00	292.89	2.57	295.46	64.0	9.93	1.53	296.99	.00	2.57		3.00	.00	.00	0	.00
JUNCT STR	.01700					.00646	.06						.00		
10860.00	293.06	4.13	297.19	44.0	6.22	.60	297.79	.00	2.16		3.00	.00	.00	0	.00
316.58	.00800					.00432	1.37			1.91			.00		
11176.58	295.59	3.00	298.59	44.0	6.22	.60	299.19	.00	2.16		3.00	.00	.00	0	.00
55.04	.00800					.00405	.22			1.91			.00		
11231.63	296.03	2.72	298.75	44.0	6.53	.66	299.42	.00	2.16		3.00	.00	.00	0	.00
23.34	.00800					.00394	.09			1.91			.00		
11254.97	296.22	2.56	298.78	44.0	6.85	.73	299.51	.00	2.16		3.00	.00	.00	0	.00
15.61	.00800					.00426	.07			1.91			.00		
11270.57	296.34	2.43	298.78	44.0	7.17	.80	299.57	.00	2.16		3.00	.00	.00	0	.00
HYDRAULIC JUMP													.00		
11270.57	296.34	1.91	298.26	44.0	9.24	1.33	299.59	.00	2.16		3.00	.00	.00	0	.00
632.24	.00800					.00801	5.07			1.91			.00		
11902.82	301.40	1.91	303.32	44.0	9.24	1.33	304.64	.00	2.16		3.00	.00	.00	0	.00

47.18	.00800					.00803	.38			1.91			.00		
11950.00	301.78	1.91	303.69	44.0	9.25	1.33	305.02	.00	2.16		3.00	.00	.00	0	.00
12.46	.00802					.00804	.10			1.91			.00		
11962.46	301.88	1.91	303.79	44.0	9.25	1.33	305.12	.00	2.16		3.00	.00	.00	0	.00
94.35	.00802					.00765	.72			1.91			.00		
12056.81	302.64	1.98	304.62	44.0	8.88	1.23	305.84	.00	2.16		3.00	.00	.00	0	.00
22.10	.00802					.00687	.15			1.91			.00		
12078.91	302.81	2.07	304.88	44.0	8.47	1.11	306.00	.00	2.16		3.00	.00	.00	0	.00
4.45	.00802					.00612	.03			1.91			.00		
12083.36	302.85	2.16	305.01	44.0	8.07	1.01	306.02	.00	2.16		3.00	.00	.00	0	.00
JUNCT STR	.00781					.00370	.06						.00		
12100.00	302.98	3.34	306.32	27.0	3.82	.23	306.55	.00	1.68		3.00	.00	.00	0	.00
32.78	.00793					.00164	.05			1.42			.00		
12132.78	303.24	3.14	306.38	27.0	3.82	.23	306.60	.00	1.68		3.00	.00	.00	0	.00
105.90	.00329					.00163	.17			1.86			.00		
12238.68	303.59	3.00	306.59	27.0	3.82	.23	306.82	.00	1.68		3.00	.00	.00	0	.00
144.05	.00329					.00152	.22			1.86			.00		
12382.73	304.06	2.72	306.78	27.0	4.01	.25	307.03	.00	1.68		3.00	.00	.00	0	.00
75.11	.00329					.00148	.11			1.86			.00		
12457.84	304.31	2.56	306.87	27.0	4.20	.27	307.15	.00	1.68		3.00	.00	.00	0	.00
62.50	.00329					.00161	.10			1.86			.00		
12520.34	304.52	2.43	306.94	27.0	4.41	.30	307.25	.00	1.68		3.00	.00	.00	0	.00
56.82	.00329					.00177	.10			1.86			.00		
12577.16	304.70	2.31	307.01	27.0	4.62	.33	307.35	.00	1.68		3.00	.00	.00	0	.00
53.82	.00329					.00196	.11			1.86			.00		
12630.98	304.88	2.21	307.09	27.0	4.85	.37	307.45	.00	1.68		3.00	.00	.00	0	.00
53.75	.00329					.00219	.12			1.86			.00		
12684.73	305.06	2.11	307.17	27.0	5.08	.40	307.57	.00	1.68		3.00	.00	.00	0	.00
57.91	.00329					.00245	.14			1.86			.00		
12742.63	305.25	2.02	307.27	27.0	5.33	.44	307.71	.00	1.68		3.00	.00	.00	0	.00
71.85	.00329					.00275	.20			1.86			.00		
12814.48	305.49	1.94	307.42	27.0	5.59	.49	307.91	.00	1.68		3.00	.00	.00	0	.00
148.07	.00329					.00310	.46			1.86			.00		
12962.55	305.97	1.86	307.83	27.0	5.86	.53	308.37	.00	1.68		3.00	.00	.00	0	.00
62.45	.00329					.00329	.21			1.86			.00		
13025.00	306.18	1.86	308.04	27.0	5.86	.53	308.57	.00	1.68		3.00	.00	.00	0	.00
70.00	.00329					.00329	.23			1.86			.00		
13095.00	306.41	1.86	308.27	27.0	5.86	.53	308.80	.00	1.68		3.00	.00	.00	0	.00

66th Street Lateral (66th6100.out)

```
STORM DRAIN ANALYSIS PLUS

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 Version □□□□□
 Serial Number □□□□□□□□

 Oct  6, 1997  17:20:17

 Input file : 66th6100.dat
 Output file: 66th6100.out


                                INPUT FILE LISTING


T1 STP Papago - 091131.00 - Recommended Plan Analysis
T2 Oak Street Storm Drain - 66th Street Lateral - STA 81+22.54
T3 6 HR 100 YR Storm
SO   1000.00 253.26  4                          261.49
R    1014.88 253.29  4      .013
TS   1024.33 253.31  1      .013
R    1127.22 253.51  1      .013                              65.50
R    1156.94 253.57  1      .013
R    1197.17 253.65  1      .013                              12.80
R    2050.72 255.36  1      .013                                     5.12 1
JX   2085.17 255.43  1  3   .013    61.          255.98       83.39
R    2136.78 255.53  1      .013                                     5.00 1
TS   2156.22 255.57  2      .013
R    2689.03 256.64  2      .013                                    38.00 2
R    2718.85 256.70  2      .013
SH                   2
                                                        SP
                          WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

 CD      1    4                      6.00
 CD      2    4                      5.50
 CD      3    4                      4.50
 CD      4    3      0       .00     4.50    7.00    .00   .00   .00

                        WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                          STP Papago - 091131.00 - Recommended Plan Analysis
HEADING LINE NO 2 IS -
                          Oak Street Storm Drain - 66th Street Lateral - STA 81+22.54
HEADING LINE NO 3 IS -
                          6 HR 100 YR Storm

                        WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                1000.00  253.26    4                                       261.49
 ELEMENT NO   2 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                1014.88  253.29    4              .013                                  .00    .00     .00      0
 ELEMENT NO   3 IS A TRANSITION        *         *     *
                    U/S DATA   STATION    INVERT  SECT              N
                                1024.33  253.31    1              .013
 ELEMENT NO   4 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                1127.22  253.51    1              .013                                  .00  65.50     .00      0
 ELEMENT NO   5 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                1156.94  253.57    1              .013                                  .00    .00     .00      0
 ELEMENT NO   6 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                1197.17  253.65    1              .013                                  .00  12.80     .00      0
 ELEMENT NO   7 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                2050.72  255.36    1              .013                                  .00    .00    5.12      1
 ELEMENT NO   8 IS A JUNCTION          *         *     *     *                 *                 *                 *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                2085.17  255.43    1     3     0   .013    61.0       .0   255.98      .00  83.39     .00
 ELEMENT NO   9 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                2136.78  255.53    1              .013                                  .00    .00    5.00      1
 ELEMENT NO  10 IS A TRANSITION        *         *     *
                    U/S DATA   STATION    INVERT  SECT              N
                                2156.22  255.57    2              .013
 ELEMENT NO  11 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                2689.03  256.64    2              .013                                  .00    .00   38.00      2
 ELEMENT NO  12 IS A REACH             *         *     *
                    U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                                2718.85  256.70    2              .013                                  .00    .00     .00      0
 ELEMENT NO  13 IS A SYSTEM HEADWORKS                *                 *
                    U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                                2718.85  256.70    2                                          .00

                        WATER SURFACE PROFILE - ELEMENT CARD LISTING
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

                                WATER SURFACE PROFILE LISTING
                      STP Papago - 091131.00 - Recommended Plan Analysis
                      Oak Street Storm Drain - 66th Street Lateral - STA 81+22.54
```

6 HR 100 YR Storm

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
1000.00	253.26	8.23	261.49	241.0	7.71	.92	262.41	.00	3.33		4.50	7.00	.00	0	.00
14.88	.00202					.00302	.05			4.32			.00		
1014.88	253.29	8.25	261.54	241.0	7.71	.92	262.46	.00	3.33		4.50	7.00	.00	0	.00
TRANS STR	.00212					.00313	.03						.00		
1024.33	253.31	8.09	261.40	241.0	8.52	1.13	262.53	.00	4.25		6.00	.00	.00	0	.00
102.89	.00194					.00324	.33			6.00			.00		
1127.22	253.51	8.42	261.93	241.0	8.52	1.13	263.06	.00	4.25		6.00	.00	.00	0	.00
29.72	.00202					.00324	.10			6.00			.00		
1156.94	253.57	8.45	262.02	241.0	8.52	1.13	263.15	.00	4.25		6.00	.00	.00	0	.00
40.23	.00199					.00324	.13			6.00			.00		
1197.17	253.65	8.59	262.24	241.0	8.52	1.13	263.37	.00	4.25		6.00	.00	.00	0	.00
853.55	.00200					.00324	2.76			6.00			.00		
2050.72	255.36	9.72	265.08	241.0	8.52	1.13	266.21	.00	4.25		6.00	.00	.00	0	.00
JUNCT STR	.00203					.00252	.09						.00		
2085.17	255.43	10.70	266.13	180.0	6.37	.63	266.76	.00	3.66		6.00	.00	.00	0	.00
51.61	.00194					.00181	.09			4.74			.00		
2136.78	255.53	10.74	266.27	180.0	6.37	.63	266.90	.00	3.66		6.00	.00	.00	0	.00
TRANS STR	.00206					.00234	.05						.00		
2156.22	255.57	10.53	266.10	180.0	7.58	.89	267.00	.00	3.75		5.50	.00	.00	0	.00
532.81	.00201					.00287	1.53			5.50			.00		
2689.03	256.64	11.20	267.84	180.0	7.58	.89	268.73	.00	3.75		5.50	.00	.00	0	.00
29.82	.00201					.00287	.09			5.50			.00		
2718.85	256.70	11.22	267.92	180.0	7.58	.89	268.81	.00	3.75		5.50	.00	.00	0	.00

64th Street Lateral (64th6100.out)

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STORM DRAIN ANALYSIS PLUS

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Version □□□□□
Serial Number □□□□□□□□

Oct  2, 1997  14: 6:10

Input file : 64th6100.dat
Output file: 64th6100.out

                                INPUT FILE LISTING


T1 STP Papago - 091131.00 - Recommended Plan Analysis
T2 Oak Street Storm Drain - 64th Street Lateral - STA 94+11.76
T3 6 HR 100 YR Storm
SO   1000.00 270.83  1                        282.13
R    1250.00 274.54  1      .013                                  2.25 1
R    1650.00 275.86  1      .013                                  1.25 1
R    2050.00 277.18  1      .013                                 45.00 1
R    2126.30 277.43  1      .013
SH                   1
                                                        SP
                                WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    4                       5.50

                          WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                            STP Papago - 091131.00 - Recommended Plan Analysis
 HEADING LINE NO 2 IS -
                            Oak Street Storm Drain - 64th Street Lateral - STA 94+11.76
 HEADING LINE NO 3 IS -
                            6 HR 100 YR Storm

                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
  ELEMENT NO   1 IS A SYSTEM OUTLET     *         *     *
                     U/S DATA   STATION    INVERT  SECT                                  W S ELEV
                                 1000.00  270.83    1                                     282.13
  ELEMENT NO   2 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                 1250.00  274.54    1             .013                           .00    .00    2.20     5
  ELEMENT NO   3 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                 1650.00  275.86    1             .013                           .00    .00    1.20     5
  ELEMENT NO   4 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                 2050.00  277.18    1             .013                           .00    .00   45.00     0
  ELEMENT NO   5 IS A REACH             *         *     *
                     U/S DATA   STATION    INVERT  SECT              N                          RADIUS  ANGLE  ANG PT  MAN H
                                 2126.30  277.43    1             .013                           .00    .00     .00     0
  ELEMENT NO   6 IS A SYSTEM HEADWORKS                *                     *
                     U/S DATA   STATION    INVERT  SECT                                  W S ELEV
                                 2126.30  277.43    1                                        .00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

                                WATER SURFACE PROFILE LISTING
                        STP Papago - 091131.00 - Recommended Plan Analysis
                        Oak Street Storm Drain - 64th Street Lateral - STA 94+11.76
                        6 HR 100 YR Storm
  STATION    INVERT   DEPTH     W.S.       Q       VEL     VEL     ENERGY   SUPER  CRITICAL          HGT/    BASE/    ZL   NO  AVBPR
             ELEV   OF FLOW     ELEV                       HEAD   GRD.EL.   ELEV   DEPTH                DIA    ID NO.        PIER
  L/ELEM      SO                                         SF AVE     HF                     NORM DEPTH                    ZR
*****************************************************************************************************************************
   1000.00   270.83    11.30    282.13    140.0    5.89     .54   282.67    .00    3.30                5.50     .00   .00   0    .00
    250.00   .01484                                     .00174     .43                      2.22                        .00
   1250.00   274.54     8.16    282.70    140.0    5.89     .54   283.24    .00    3.30                5.50     .00   .00   0    .00
    400.00   .00330                                     .00174     .70                      3.47                        .00
   1650.00   275.86     7.68    283.54    140.0    5.89     .54   284.08    .00    3.30                5.50     .00   .00   0    .00
    400.00   .00330                                     .00174     .70                      3.47                        .00
   2050.00   277.18     7.13    284.31    140.0    5.89     .54   284.85    .00    3.30                5.50     .00   .00   0    .00
     76.30   .00328                                     .00174     .13                      3.48                        .00
   2126.30   277.43     7.01    284.44    140.0    5.89     .54   284.98    .00    3.30                5.50     .00   .00   0    .00
```

Osborn Road Outfall -Indian Bend Wash to Pauite Park (osb610.out)

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
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Version □□□□□
Serial Number □□□□□□□□

Oct 7, 1997 9:26:52

Input file : osb610.dat
Output file: osb610.out

INPUT FILE LISTING

```
T1 STP Papago - 091131.00
T2 Osborn Road Storm Drain- Civic Center Blvd. to Paiute Park- Reccomended Plan
T3 6 HR 10 YR Storm
SO   2385.37 219.88  1                          235.00
R    2436.82 219.93  1      .013                              19.56
R    2464.89 219.96  1
TS   2484.89 223.98  2      .013
JX   2503.78 224.00  2  8 9 .013     6.0    6.0  223.29 223.29 90.00 90.00
R    2509.89 224.01  2      .013
TS   2529.89 220.02  1      .013
R    3000.00 220.65  1      .013                                          1
JX   3155.73 220.65  1 21   .013    75.0         228.59        90.00
R    3500.00 220.99  1      .013                                          1
JX   3632.77 221.13  1  5   .013    50.0         230.39        90.00
R    3750.00 221.24  1      .013
TS   3800.00 221.38 18      .013
R    3825.00 221.46 18      .013
JX   3832.29 221.48 18 15   .013    30.0         221.48        90.00
R    3850.00 221.53 18      .013
TS   3900.00 221.67  1      .013
R    4632.00 223.72  1      .013                                          2
TS   4690.00 223.88 18      .013
JX   4700.00 223.91 18 10 7 .013    25.0    16.0 224.41 224.41 90.00 90.00
R    4714.44 223.95 18      .013
R    4740.00 224.06 18      .013
TS   4790.00 224.28  1      .013
R    4899.45 224.76  1      .013                                     4.96
R    5093.70 225.62  1      .013                                     4.96 1
JX   5124.13 225.75  1  4   .013   121.0         228.75        90.00
R    5163.70 225.92  1      .013
TS   5185.70 226.02  3      .013
R    5217.47 226.16  3      .013                                     5.00
R    5409.00 227.00  3      .013
R    5606.38 227.47  3      .013                                     4.26 1
R    6400.00 229.36  3      .013                                          1
JX   6439.00 229.45  3  8   .013   101.0         231.20        90.00
TS   6449.00 229.48 24      .013
R    7250.00 231.75 24      .013                                          2
R    7700.00 239.39 24      .013                                          1
JX   7741.00 240.09 24 20   .013   109.0         241.09        90.00
TS   7751.00 240.26  5      .013
R    8100.00 240.78  5      .013                                          1
R    8139.55 240.83  5      .013
TS   8179.55 240.89 22      .013
R    8210.55 240.94 22      .013
TS   8250.55 241.09  5      .013
R    8439.44 241.79  5      .013                                     5.00
R    8700.00 242.76  5      .013                                          1
JX   8759.00 242.98  5 10   .013    99.0         243.48        90.00
TS   8774.00 243.04 20      .013
R    8948.07 243.68 20      .013
R    9000.00 243.88 20      .013                              34.02
TS   9025.00 243.97 23      .013
R    9055.00 244.08 23      .013                              12.73
TS   9075.00 244.37 20      .013
R    9160.13 245.58 20      .013                              43.25
R    9793.42 248.01 20      .013                                          2
R    9934.27 248.56 20      .013                              90.33
R    9958.83 248.65 20      .013
SH                  20
                                                   SP
                                WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING
CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH                DROP

CD      1    4                      9.50
CD      2    3     0        .00     5.50    9.50    .00   .00   .00
CD      3    4                      8.00
CD      4    4                      5.50
CD      5    4                      6.00
CD      6    3     1        .75     5.00   16.75    .00   .00   .00
CD      7    4                      2.00
CD      8    4                      4.50
CD      9    4                      3.50
CD     10    4                      4.00
CD     11    3     0        .00     4.00    7.00    .00   .00   .00
CD     15    4                      3.00
CD     16    3     1        .75     5.00   12.75    .00   .00   .00
CD     18    3     0        .00     5.00    9.00    .00   .00   .00
CD     19    4                      4.07
CD     20    4                      5.00
CD     21    4                      1.50
```

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CD     22    3     0        .00      3.00    8.50    .00    .00    .00
CD     23    3     0        .00      3.50    5.00    .00    .00    .00
CD     24    4                       7.00

                    WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                      STP Papago - 091131.00
HEADING LINE NO 2 IS -
                      Osborn Road Storm Drain- Civic Center Blvd. to Paiute Park- Reccomended Pl
HEADING LINE NO 3 IS -
                      6 HR 10 YR Storm

                    WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO   1 IS A SYSTEM OUTLET      *        *      *
                  U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                               2385.37  219.88    1                                       235.00
 ELEMENT NO   2 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               2436.82  219.93    1              .013                                 .00   19.56    .00     0
 ELEMENT NO   3 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               2464.89  219.96    1              .014                                 .00    .00     .00     0
 ELEMENT NO   4 IS A TRANSITION         *        *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               2484.89  223.98    2              .013
 ELEMENT NO   5 IS A JUNCTION           *        *      *      *                  *                  *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               2503.78  224.00    2     8     9   .013     6.0      6.0   223.29   223.29  90.00   90.00
 ELEMENT NO   6 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               2509.89  224.01    2              .013                                 .00    .00     .00     0
 ELEMENT NO   7 IS A TRANSITION         *        *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               2529.89  220.02    1              .013
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 ELEMENT NO   8 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               3000.00  220.65    1              .013                                 .00    .00     .00     1
 ELEMENT NO   9 IS A JUNCTION           *        *      *      *                  *                  *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               3155.73  220.65    1    21     0   .013    75.0       .0   228.59      .00  90.00     .00
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 ELEMENT NO  10 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               3500.00  220.99    1              .013                                 .00    .00     .00     1
 ELEMENT NO  11 IS A JUNCTION           *        *      *      *                  *                  *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               3632.77  221.13    1     5     0   .013    50.0       .0   230.39      .00  90.00     .00

                    WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO  12 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               3750.00  221.24    1              .013                                 .00    .00     .00     0
 ELEMENT NO  13 IS A TRANSITION         *        *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               3800.00  221.38   18              .013
 ELEMENT NO  14 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               3825.00  221.46   18              .013                                 .00    .00     .00     0
 ELEMENT NO  15 IS A JUNCTION           *        *      *      *                  *                  *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               3832.29  221.48   18    15     0   .013    30.0       .0   221.48      .00  90.00     .00
 ELEMENT NO  16 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               3850.00  221.53   18              .013                                 .00    .00     .00     0
 ELEMENT NO  17 IS A TRANSITION         *        *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               3900.00  221.67    1              .013
 ELEMENT NO  18 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               4632.00  223.72    1              .013                                 .00    .00     .00     2
 ELEMENT NO  19 IS A TRANSITION         *        *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               4690.00  223.88   18              .013
 ELEMENT NO  20 IS A JUNCTION           *        *      *      *                  *                  *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               4700.00  223.91   18    10     7   .013    25.0      16.0   224.41   224.41  90.00   90.00
 ELEMENT NO  21 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               4714.44  223.95   18              .013                                 .00    .00     .00     0
 ELEMENT NO  22 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               4740.00  224.06   18              .013                                 .00    .00     .00     0
 ELEMENT NO  23 IS A TRANSITION         *        *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               4790.00  224.28    1              .013

                    WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO  24 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               4899.45  224.76    1              .013                                 .00    .00    4.96     0
 ELEMENT NO  25 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               5093.70  225.62    1              .013                                 .00    .00    4.96     1
 ELEMENT NO  26 IS A JUNCTION           *        *      *      *                  *                  *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               5124.13  225.75    1     4     0   .013   121.0       .0   228.75      .00  90.00     .00
 ELEMENT NO  27 IS A REACH              *        *      *
                  U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               5163.70  225.92    1              .013                                 .00    .00     .00     0
 ELEMENT NO  28 IS A TRANSITION         *        *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               5185.70  226.02    3              .013
 ELEMENT NO  29 IS A REACH              *        *      *
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                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               5217.47  226.16    3               .013                                        .00    .00    5.00      0
ELEMENT NO  30 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               5409.00  227.00    3               .013                                        .00    .00     .00      0
ELEMENT NO  31 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               5606.38  227.47    3               .013                                        .00    .00    4.26      1
ELEMENT NO  32 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               6400.00  229.36    3               .013                                        .00    .00     .00      1
ELEMENT NO  33 IS A JUNCTION      *            *      *      *                *                  *                  *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N       Q3        Q4     INVERT-3 INVERT-4  PHI 3   PHI 4
                               6439.00  229.45    3     8      0  .013     101.0        .0   231.20      .00   90.00     .00
ELEMENT NO  34 IS A TRANSITION    *            *      *
                    U/S DATA   STATION    INVERT  SECT              N
                               6449.00  229.48   24               .013

                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
ELEMENT NO  35 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               7250.00  231.75   24               .013                                        .00    .00     .00      2
ELEMENT NO  36 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               7700.00  239.39   24               .013                                        .00    .00     .00      1
ELEMENT NO  37 IS A JUNCTION      *            *      *      *                *                  *                  *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N       Q3        Q4     INVERT-3 INVERT-4  PHI 3   PHI 4
                               7741.00  240.09   24    20      0  .013     109.0        .0   241.09      .00   90.00     .00
ELEMENT NO  38 IS A TRANSITION    *            *      *
                    U/S DATA   STATION    INVERT  SECT              N
                               7751.00  240.26    5               .013
ELEMENT NO  39 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               8100.00  240.78    5               .013                                        .00    .00     .00      1
ELEMENT NO  40 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               8139.55  240.83    5               .013                                        .00    .00     .00      0
ELEMENT NO  41 IS A TRANSITION    *            *      *
                    U/S DATA   STATION    INVERT  SECT              N
                               8179.55  240.89   22               .013
ELEMENT NO  42 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               8210.55  240.94   22               .013                                        .00    .00     .00      0
ELEMENT NO  43 IS A TRANSITION    *            *      *
                    U/S DATA   STATION    INVERT  SECT              N
                               8250.55  241.09    5               .013
ELEMENT NO  44 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               8439.44  241.79    5               .013                                        .00    .00    5.00      0
ELEMENT NO  45 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               8700.00  242.76    5               .013                                        .00    .00     .00      1
ELEMENT NO  46 IS A JUNCTION      *            *      *      *                *                  *                  *
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2  N       Q3        Q4     INVERT-3 INVERT-4  PHI 3   PHI 4
                               8759.00  242.98    5    10      0  .013      99.0        .0   243.48      .00   90.00     .00
ELEMENT NO  47 IS A TRANSITION    *            *      *
                    U/S DATA   STATION    INVERT  SECT              N
                               8774.00  243.04   20               .013
ELEMENT NO  48 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               8948.07  243.68   20               .013                                        .00    .00     .00      0
ELEMENT NO  49 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               9000.00  243.88   20               .013                                        .00  34.02     .00      0
ELEMENT NO  50 IS A TRANSITION    *            *      *
                    U/S DATA   STATION    INVERT  SECT              N
                               9025.00  243.97   23               .013
ELEMENT NO  51 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               9055.00  244.08   23               .013                                        .00  12.73     .00      0
ELEMENT NO  52 IS A TRANSITION    *            *      *
                    U/S DATA   STATION    INVERT  SECT              N
                               9075.00  244.37   20               .013
ELEMENT NO  53 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               9160.13  245.58   20               .013                                        .00  43.25     .00      0
ELEMENT NO  54 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               9793.42  248.01   20               .013                                        .00    .00     .00      2
ELEMENT NO  55 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               9934.27  248.56   20               .013                                        .00  90.33     .00      0
ELEMENT NO  56 IS A REACH         *            *      *
                    U/S DATA   STATION    INVERT  SECT              N                                        RADIUS  ANGLE  ANG PT  MAN H
                               9958.83  248.65   20               .013                                        .00    .00     .00      0
ELEMENT NO  57 IS A SYSTEM HEADWORKS                  *                       *
                    U/S DATA   STATION    INVERT  SECT                                      W S ELEV
                               9958.83  248.65   20                                             .00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

                                                  WATER SURFACE PROFILE LISTING
                         STP Papago - 091131.00
                         Osborn Road Storm Drain- Civic Center Blvd. to Paiute Park- Reccomended Pl
                         6 HR 10 YR Storm
STATION     INVERT   DEPTH    W.S.       Q       VEL     VEL    ENERGY   SUPER  CRITICAL            HGT/    BASE/    ZL   NO  AVBPR
             ELEV   OF FLOW   ELEV                       HEAD   GRD.EL.  ELEV    DEPTH              DIA     ID NO.       PIER
L/ELEM       SO                                          SF AVE   HF                      NORM DEPTH                 ZR
****************************************************************************************************************************
  2385.37   219.88    15.12   235.00    709.0   10.00     1.55   236.55    .00     6.50              9.50      .00   .00   0    .00
    51.45   .00097                                      .00242      .12                      9.50                    .00
  2436.82   219.93    15.34   235.27    709.0   10.00     1.55   236.82    .00     6.50              9.50      .00   .00   0    .00
    28.07   .00107                                      .00280      .08                      9.50                    .00
  2464.89   219.96    15.39   235.35    709.0   10.00     1.55   236.90    .00     6.50              9.50      .00   .00   0    .00
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TRANS STR	.20100					.00462	.09						.00		
2484.89	223.98	10.39	234.37	709.0	13.63	2.89	237.26	.00	5.50		5.50	9.50	.00	0	.00
JUNCT STR	.00106					.00672	.13						.00		
2503.78	224.00	10.69	234.69	697.0	13.40	2.79	237.49	.00	5.50		5.50	9.50	.00	0	.00
6.11	.00164					.00660	.04			5.50			.00		
2509.89	224.01	10.72	234.73	697.0	13.40	2.79	237.53	.00	5.50		5.50	9.50	.00	0	.00
TRANS STR	-.19950					.00447	.09						.00		
2529.89	220.02	16.22	236.24	697.0	9.83	1.50	237.74	.00	6.44		9.50	.00	.00	0	.00
470.11	.00134					.00234	1.10			9.50			.00		
3000.00	220.65	16.77	237.42	697.0	9.83	1.50	238.92	.00	6.44		9.50	.00	.00	0	.00
JUNCT STR	.00000					.00210	.33						.00		
3155.73	220.65	17.70	238.35	622.0	8.78	1.20	239.55	.00	6.07		9.50	.00	.00	0	.00
344.27	.00099					.00186	.64			9.50			.00		
3500.00	220.99	18.06	239.05	622.0	8.78	1.20	240.25	.00	6.07		9.50	.00	.00	0	.00
JUNCT STR	.00105					.00172	.23						.00		
3632.77	221.13	18.52	239.65	572.0	8.07	1.01	240.66	.00	5.82		9.50	.00	.00	0	.00
117.23	.00094					.00157	.18			9.50			.00		
3750.00	221.24	18.60	239.84	572.0	8.07	1.01	240.85	.00	5.82		9.50	.00	.00	0	.00
TRANS STR	.00280					.00413	.21						.00		
3800.00	221.38	17.44	238.82	572.0	12.78	2.54	241.36	.00	5.00		5.00	9.00	.00	0	.00
25.00	.00320					.00669	.17			5.00			.00		
3825.00	221.46	17.53	238.99	572.0	12.78	2.54	241.53	.00	5.00		5.00	9.00	.00	0	.00
JUNCT STR	.00274					.00635	.05						.00		
3832.29	221.48	18.07	239.55	542.0	12.11	2.28	241.83	.00	4.83		5.00	9.00	.00	0	.00
17.71	.00282					.00601	.11			5.00			.00		
3850.00	221.53	18.13	239.66	542.0	12.11	2.28	241.94	.00	4.83		5.00	9.00	.00	0	.00
TRANS STR	.00280					.00371	.19						.00		
3900.00	221.67	19.68	241.35	542.0	7.65	.91	242.26	.00	5.66		9.50	.00	.00	0	.00
732.00	.00280					.00141	1.03			5.91			.00		
4632.00	223.72	18.76	242.48	542.0	7.65	.91	243.39	.00	5.66		9.50	.00	.00	0	.00
TRANS STR	.00276					.00371	.22						.00		
4690.00	223.88	17.72	241.60	542.0	12.11	2.28	243.88	.00	4.83		5.00	9.00	.00	0	.00
JUNCT STR	.00300					.00557	.06						.00		
4700.00	223.91	18.41	242.32	501.0	11.20	1.95	244.26	.00	4.58		5.00	9.00	.00	0	.00
14.44	.00277					.00513	.07			5.00			.00		
4714.44	223.95	18.44	242.39	501.0	11.20	1.95	244.34	.00	4.58		5.00	9.00	.00	0	.00
25.56	.00430					.00513	.13			4.37			.00		
4740.00	224.06	18.46	242.52	501.0	11.20	1.95	244.47	.00	4.58		5.00	9.00	.00	0	.00
TRANS STR	.00440					.00317	.16						.00		
4790.00	224.28	19.69	243.97	501.0	7.07	.78	244.74	.00	5.43		9.50	.00	.00	0	.00
109.45	.00439					.00121	.13			4.89			.00		
4899.45	224.76	19.35	244.11	501.0	7.07	.78	244.89	.00	5.43		9.50	.00	.00	0	.00
194.25	.00443					.00121	.23			4.87			.00		
5093.70	225.62	18.78	244.40	501.0	7.07	.78	245.17	.00	5.43		9.50	.00	.00	0	.00
JUNCT STR	.00427					.00095	.03						.00		
5124.13	225.75	19.34	245.09	380.0	5.36	.45	245.53	.00	4.70		9.50	.00	.00	0	.00
39.57	.00430					.00069	.03			4.19			.00		
5163.70	225.92	19.19	245.11	380.0	5.36	.45	245.56	.00	4.70		9.50	.00	.00	0	.00
TRANS STR	.00455					.00121	.03						.00		
5185.70	226.02	18.77	244.79	380.0	7.56	.89	245.68	.00	4.95		8.00	.00	.00	0	.00
31.77	.00441					.00174	.06			4.59			.00		
5217.47	226.16	18.70	244.86	380.0	7.56	.89	245.75	.00	4.95		8.00	.00	.00	0	.00
191.53	.00439					.00174	.33			4.60			.00		
5409.00	227.00	18.19	245.19	380.0	7.56	.89	246.08	.00	4.95		8.00	.00	.00	0	.00
197.38	.00238					.00174	.34			5.68			.00		
5606.38	227.47	18.12	245.59	380.0	7.56	.89	246.48	.00	4.95		8.00	.00	.00	0	.00
793.62	.00238					.00174	1.38			5.68			.00		
6400.00	229.36	17.65	247.01	380.0	7.56	.89	247.90	.00	4.95		8.00	.00	.00	0	.00
JUNCT STR	.00231					.00134	.05						.00		
6439.00	229.45	18.43	247.88	279.0	5.55	.48	248.36	.00	4.21		8.00	.00	.00	0	.00
TRANS STR	.00300					.00142	.01						.00		
6449.00	229.48	18.15	247.63	279.0	7.25	.82	248.44	.00	4.39		7.00	.00	.00	0	.00
801.00	.00283					.00191	1.53			4.82			.00		
7250.00	231.75	17.49	249.24	279.0	7.25	.82	250.05	.00	4.39		7.00	.00	.00	0	.00
450.00	.01698					.00191	.86			2.79			.00		
7700.00	239.39	10.74	250.13	279.0	7.25	.82	250.95	.00	4.39		7.00	.00	.00	0	.00
JUNCT STR	.01707					.00131	.05						.00		
7741.00	240.09	11.13	251.22	170.0	4.42	.30	251.52	.00	3.39		7.00	.00	.00	0	.00
TRANS STR	.01700					.00116	.01						.00		
7751.00	240.26	10.76	251.02	170.0	6.01	.56	251.58	.00	3.55		6.00	.00	.00	0	.00
349.00	.00149					.00161	.56			5.16			.00		
8100.00	240.78	10.83	251.61	170.0	6.01	.56	252.17	.00	3.55		6.00	.00	.00	0	.00
39.55	.00126					.00161	.06			6.00			.00		
8139.55	240.83	10.84	251.67	170.0	6.01	.56	252.24	.00	3.55		6.00	.00	.00	0	.00
TRANS STR	.00150					.00234	.09						.00		
8179.55	240.89	10.76	251.65	170.0	6.73	.70	252.36	.00	2.32		3.00	8.50	.00	0	.00
31.00	.00161					.00306	.09			2.99			.00		
8210.55	240.94	10.81	251.75	170.0	6.73	.70	252.45	.00	2.32		3.00	8.50	.00	0	.00
TRANS STR	.00375					.00234	.09						.00		
8250.55	241.09	10.91	252.00	170.0	6.01	.56	252.56	.00	3.55		6.00	.00	.00	0	.00
188.89	.00371					.00161	.30			3.56			.00		
8439.44	241.79	10.52	252.31	170.0	6.01	.56	252.87	.00	3.55		6.00	.00	.00	0	.00
260.56	.00372					.00161	.42			3.55			.00		
8700.00	242.76	10.00	252.76	170.0	6.01	.56	253.32	.00	3.55		6.00	.00	.00	0	.00
JUNCT STR	.00373					.00095	.06						.00		
8759.00	242.98	10.76	253.74	71.0	2.51	.10	253.84	.00	2.25		6.00	.00	.00	0	.00
TRANS STR	.00400					.00051	.01						.00		
8774.00	243.04	10.63	253.67	71.0	3.62	.20	253.87	.00	2.38		5.00	.00	.00	0	.00
174.07	.00368					.00074	.13			2.35			.00		
8948.07	243.68	10.12	253.80	71.0	3.62	.20	254.00	.00	2.38		5.00	.00	.00	0	.00
51.93	.00385					.00074	.04			2.32			.00		
9000.00	243.88	9.98	253.86	71.0	3.62	.20	254.06	.00	2.38		5.00	.00	.00	0	.00
TRANS STR	.00360					.00101	.03						.00		
9025.00	243.97	9.87	253.84	71.0	4.12	.26	254.10	.00	1.84		3.50	5.00	.00	0	.00
30.00	.00367					.00127	.04			1.94			.00		
9055.00	244.08	9.82	253.90	71.0	4.12	.26	254.16	.00	1.84		3.50	5.00	.00	0	.00
TRANS STR	.01450					.00101	.02						.00		
9075.00	244.37	9.61	253.98	71.0	3.62	.20	254.18	.00	2.38		5.00	.00	.00	0	.00
85.13	.01421					.00074	.06			1.63			.00		
9160.13	245.58	8.49	254.07	71.0	3.62	.20	254.28	.00	2.38		5.00	.00	.00	0	.00
633.29	.00384					.00074	.47			2.32			.00		
9793.42	248.01	6.55	254.56	71.0	3.62	.20	254.77	.00	2.38		5.00	.00	.00	0	.00
140.85	.00390					.00074	.10			2.31			.00		
9934.27	248.56	6.15	254.71	71.0	3.62	.20	254.91	.00	2.38		5.00	.00	.00	0	.00
24.56	.00366					.00074	.02			2.35			.00		

9958.83	248.65	6.08	254.73	71.0	3.62	.20	254.93	.00	2.38	5.00	.00	.00	0	.00

Osborn Road Outfall - Pauite Park to Marriott Homes Basin (osbs610.out)

```
STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
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Version □□□□□
Serial Number □□□□□□□□

Oct  6, 1997  16:23:11

Input file : OSBS610.DAT
Output file: OSBS610.OUT

                                INPUT FILE LISTING


T1 STP Papago - 091131.00 - Recommended Plan Analysis
T2 Osborn Road Storm Drain- Paiute Park to Marriott Homes Basin
T3 6 HR 100 YR Storm - Begin WS @ Basin Peak
SO  10611.07 250.00  1                        254.24
R   10906.04 250.30  1      .013
R   11046.85 250.44  1      .013                                 90.48
R   11700.00 251.09  1      .013                                            2
TS  11750.00 251.14  8      .013
R   12124.15 251.89  8      .013                                            1
R   12260.58 252.16  8      .013                                 93.33
JX  12315.00 252.27  8  2   .013   116.0         253.02         90.00
R   12730.00 253.10  8      .013                                            1
TS  12750.00 253.14  7      .013
R   12766.66 253.17  7      .013                                       4.70
R   12785.00 253.21  7      .013
TS  12805.00 253.25  2      .013
R   12850.00 253.83  2      .013                                            1
R   13061.36 256.58  2      .013                                       7.05 1
R   13332.60 257.94  2      .013                                       9.83 1
R   13594.65 259.25  2      .013                                      10.37 1
R   14000.39 261.28  2      .013                                      95.67 1
JX  14005.00 261.28  2  4   .013    13.0         262.28         90.00
R   14528.73 263.92  3      .013                                      90.67 2
JX  14530.00 263.92  3  4   .013    13.0         264.67         90.00
R   14777.84 265.16  6      .013
R   14848.00 265.51  6      .013                                 90.67
R   14892.54 265.74  6      .013
SH                  6
                                                 SP
                        WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING
 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
 CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH                DROP

 CD      1    3      0      .00      3.00    9.00    .00   .00   .00
 CD      2    4                      4.00
 CD      3    4                      3.50
 CD      4    4                      2.00
 CD      5    3      0      .00      3.00    4.19    .00   .00   .00
 CD      6    4                      3.00
 CD      7    3      0      .00      3.00    4.50    .00   .00   .00
 CD      8    4                      5.50

                        WATER SURFACE PROFILE - TITLE CARD LISTING
HEADING LINE NO 1 IS -
                          STP Papago - 091131.00 - Recommended Plan Analysis
HEADING LINE NO 2 IS -
                          Osborn Road Storm Drain- Paiute Park to Marriott Homes Basin
HEADING LINE NO 3 IS -
                          6 HR 100 YR Storm - Begin WS @ Basin Peak

                        WATER SURFACE PROFILE - ELEMENT CARD LISTING
ELEMENT NO   1 IS A SYSTEM OUTLET      *        *      *
                   U/S DATA   STATION    INVERT  SECT                                  W S ELEV
                               10611.07  250.00    1                                     254.24
ELEMENT NO   2 IS A REACH         *        *      *
                   U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               10906.04  250.30    1             .013                                  .00    .00     .00      0
ELEMENT NO   3 IS A REACH         *        *      *
                   U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               11046.85  250.44    1             .013                                  .00  90.48     .00      0
ELEMENT NO   4 IS A REACH         *        *      *
                   U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               11700.00  251.09    1             .013                                  .00    .00     .00      2
ELEMENT NO   5 IS A TRANSITION    *        *      *
                   U/S DATA   STATION    INVERT  SECT              N
                               11750.00  251.14    8             .013
ELEMENT NO   6 IS A REACH         *        *      *
                   U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               12124.15  251.89    8             .013                                  .00    .00     .00      1
ELEMENT NO   7 IS A REACH         *        *      *
                   U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
                               12260.58  252.16    8             .013                                  .00  93.33     .00      0
ELEMENT NO   8 IS A JUNCTION      *        *      *      *                  *                    *                    *
                   U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               12315.00  252.27    8     2     0   .013   116.0       .0   253.02      .00  90.00     .00
ELEMENT NO   9 IS A REACH         *        *      *
                   U/S DATA   STATION    INVERT  SECT              N                                RADIUS  ANGLE  ANG PT  MAN H
```

```
                                12730.00  253.10    8              .013                                  .00    .00     .00     1
 ELEMENT NO  10 IS A TRANSITION        *         *     *
                U/S DATA   STATION    INVERT  SECT              N
                                12750.00  253.14    7              .013
 ELEMENT NO  11 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                12766.66  253.17    7              .013                                  .00    .00    4.70     0
 ELEMENT NO  12 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                12785.00  253.21    7              .013                                  .00    .00     .00     0
 ELEMENT NO  13 IS A TRANSITION        *         *     *
                U/S DATA   STATION    INVERT  SECT              N
                                12805.00  253.25    2              .013
 ELEMENT NO  14 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                12850.00  253.83    2              .013                                  .00    .00     .00     1
 ELEMENT NO  15 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                13061.36  256.58    2              .013                                  .00    .00    7.05     1
 ELEMENT NO  16 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                13332.60  257.94    2              .013                                  .00    .00    9.83     1
 ELEMENT NO  17 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                13594.65  259.25    2              .013                                  .00    .00   10.37     1
 ELEMENT NO  18 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                14000.39  261.28    2              .013                                  .00    .00   95.67     1
 ELEMENT NO  19 IS A JUNCTION          *         *     *     *          *                    *          *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                14005.00  261.28    2     4     0  .013    13.0      .0   262.28      .00  90.00     .00
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
 ELEMENT NO  20 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                14528.73  263.92    3              .013                                  .00    .00   90.67     2
 ELEMENT NO  21 IS A JUNCTION          *         *     *     *          *                    *          *
                U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3      Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                                14530.00  263.92    3     4     0  .013    13.0      .0   264.67      .00  90.00     .00
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
 ELEMENT NO  22 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                14777.84  265.16    6              .013                                  .00    .00     .00     0
 ELEMENT NO  23 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                14848.00  265.51    6              .013                                  .00  90.67     .00     0

                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
 ELEMENT NO  24 IS A REACH             *         *     *
                U/S DATA   STATION    INVERT  SECT              N                                  RADIUS  ANGLE  ANG PT  MAN H
                                14892.54  265.74    6              .013                                  .00    .00     .00     0
 ELEMENT NO  25 IS A SYSTEM HEADWORKS                *                    *
                U/S DATA   STATION    INVERT  SECT                                       W S ELEV
                                14892.54  265.74    6                                          .00
NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
```

WATER SURFACE PROFILE LISTING
STP Papago - 091131.00 - Recommended Plan Analysis
Osborn Road Storm Drain- Paiute Park to Marriott Homes Basin
6 HR 100 YR Storm - Begin WS @ Basin Peak

STATION L/ELEM	INVERT ELEV SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD SF AVE	ENERGY GRD.EL. HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL ZR	NO PIER	AVBPR
10611.07	250.00	4.24	254.24	188.0	7.03	.77	255.01	.00	2.38		3.00	9.00	.00	0	.00
294.97	.00102					.00327	.96			3.00			.00		
10906.04	250.30	4.90	255.20	188.0	7.03	.77	255.97	.00	2.38		3.00	9.00	.00	0	.00
140.81	.00099					.00327	.46			3.00			.00		
11046.85	250.44	5.38	255.82	188.0	7.03	.77	256.59	.00	2.38		3.00	9.00	.00	0	.00
653.15	.00100					.00327	2.14			3.00			.00		
11700.00	251.09	6.94	258.03	188.0	7.03	.77	258.80	.00	2.38		3.00	9.00	.00	0	.00
TRANS STR	.00100					.00320	.16						.00		
11750.00	251.14	6.89	258.03	188.0	7.91	.97	259.00	.00	3.84		5.50	.00	.00	0	.00
374.15	.00200					.00313	1.17			5.50			.00		
12124.15	251.89	7.36	259.25	188.0	7.91	.97	260.22	.00	3.84		5.50	.00	.00	0	.00
136.43	.00198					.00313	.43			5.50			.00		
12260.58	252.16	7.72	259.88	188.0	7.91	.97	260.85	.00	3.84		5.50	.00	.00	0	.00
JUNCT STR	.00202					.00180	.10						.00		
12315.00	252.27	9.36	261.63	72.0	3.03	.14	261.78	.00	2.33		5.50	.00	.00	0	.00
415.00	.00200					.00046	.19			2.68			.00		
12730.00	253.10	8.73	261.83	72.0	3.03	.14	261.97	.00	2.33		5.50	.00	.00	0	.00
TRANS STR	.00200					.00156	.03						.00		
12750.00	253.14	8.47	261.61	72.0	5.43	.46	262.07	.00	2.00		3.00	4.50	.00	0	.00
16.66	.00180					.00267	.04			2.84			.00		
12766.66	253.17	8.49	261.66	72.0	5.43	.46	262.12	.00	2.00		3.00	4.50	.00	0	.00
18.34	.00218					.00267	.05			2.63			.00		
12785.00	253.21	8.50	261.71	72.0	5.43	.46	262.17	.00	2.00		3.00	4.50	.00	0	.00
TRANS STR	.00200					.00259	.05						.00		
12805.00	253.25	8.47	261.72	72.0	5.73	.51	262.23	.00	2.57		4.00	.00	.00	0	.00
45.00	.01289					.00251	.11			1.86			.00		
12850.00	253.83	8.03	261.86	72.0	5.73	.51	262.37	.00	2.57		4.00	.00	.00	0	.00
211.36	.01301					.00251	.53			1.86			.00		
13061.36	256.58	5.85	262.43	72.0	5.73	.51	262.94	.00	2.57		4.00	.00	.00	0	.00
271.24	.00501					.00251	.68			2.48			.00		
13332.60	257.94	5.21	263.15	72.0	5.73	.51	263.66	.00	2.57		4.00	.00	.00	0	.00
262.05	.00500					.00251	.66			2.49			.00		
13594.65	259.25	4.60	263.85	72.0	5.73	.51	264.36	.00	2.57		4.00	.00	.00	0	.00
314.93	.00500					.00250	.79			2.49			.00		
13909.58	260.83	4.00	264.83	72.0	5.73	.51	265.34	.00	2.57		4.00	.00	.00	0	.00
90.81	.00500					.00233	.21			2.49			.00		

14000.39	261.28	3.72	265.00	72.0	5.91	.54	265.55	.00	2.57		4.00	.00	.00	0	.00
JUNCT STR	.00000					.00193	.01						.00		
14005.00	261.28	4.11	265.39	59.0	6.13	.58	265.97	.00	2.41		3.50	.00	.00	0	.00
523.34	.00504					.00341	1.79			2.42			.00		
14528.34	263.92	3.50	267.42	59.0	6.13	.58	268.00	.00	2.41		3.50	.00	.00	0	.00
.39	.00504					.00338	.00			2.42			.00		
14528.73	263.92	3.50	267.42	59.0	6.13	.58	268.00	.00	2.41		3.50	.00	.00	0	.00
JUNCT STR	.00000					.00273	.00						.00		
14530.00	263.92	3.96	267.88	46.0	6.51	.66	268.54	.00	2.21		3.00	.00	.00	0	.00
247.84	.00500					.00476	1.18			2.39			.00		
14777.84	265.16	3.90	269.06	46.0	6.51	.66	269.72	.00	2.21		3.00	.00	.00	0	.00
70.16	.00499					.00476	.33			2.40			.00		
14848.00	265.51	4.01	269.52	46.0	6.51	.66	270.18	.00	2.21		3.00	.00	.00	0	.00
44.54	.00516					.00476	.21			2.36			.00		
14892.54	265.74	4.00	269.74	46.0	6.51	.66	270.39	.00	2.21		3.00	.00	.00	0	.00

Appendix F -

Draft Comments and Responses

Appendix F - Draft Comments and Responses

This appendix lists the comments received by Kimley-Horn and Associates, Inc. (KHA) from the Flood Control District of Maricopa County (the District) and the Steering Committee after the draft submittal, and the responses by KHA.

Comments from H. Scott Clement:

Recommended Plan Report

1) On page 2-7, the statement is made that the existing storm drain in Osborn Road has most of the capacity necessary to convey the 10 year runoff. This statement needs to be quantified. If it is not possible to quantify the capacity a range for capacity should be provided with the corresponding event frequency.

> *Modeling of the existing system has shown that the storm drain would provide approximately 2-year protection over the entire study basin. The District has subsequently provided direction that the Osborn Road outfall shall be designed for the 10-year design storm and connected to the existing storm drain at Civic Center Boulevard. The District and the City of Scottsdale will determine the final design.*

2) On page 3-8, Table 3-3 you have provided a line item for utility relocations. Please provide backup documentation indicating the cost utilized for each type of utility relocation and its units.

> *The tables developed for determining an opinion of probable cost for utility relocations are provided in Appendix C.*

Draft Plan Set

1) In general each sheet should have the notes set up with two main headings: REMOVE and CONSTRUCT. Under each of these headings the major items of removal and construction should be listed and this should include utility relocations that will be performed by the contractor (water service, sewer service, SRP irrigation, etc.). For this level of effort in the plan set we do not expect that these items for removal and construction be tied down to station numbers and quantities.

> *A table has been created on each of the plan sheets showing REMOVE, CONSTRUCT, and RELOCATE sections.*

2) Many of the notes do not have a corresponding number on the plan view and the numbers on plan sheets have no corresponding note.

> *This has been corrected on the plan set.*

3) The proximity of the proposed storm drain to numerous existing parallel utilities is of a concern to the District. Including the wall thickness, manhole bases and variance of actual locations, the proposed storm drain could be in conflict at numerous locations. Please review and provide recommendation.

> *The two storm drain alignments were designed to provide as much space as possible between parallel utilities. In some areas there is less space available than what is desired by the utility owners. Costs associated with relocating existing utilities within a zone of influence as defined in the body of the report have been accounted for in the utility budget. The final design should include an adjustment in the storm drain alignment coordinated with the utility owners.*

4) There are numerous instances where the proposed new storm drain is within 3 to 5 feet of an existing waterline. Depending on the type of waterline pipe material, for example ACP, this could pose a safety hazard to the contractor and could require a shutdown of the waterline and by-pass. In these instances, the type of waterline pipe material needs to be determined and if it is found to be ACP, a shutdown and by-pass might be required.

> *As these plans are a planning document and not construction plans, material identification and verification shall be the responsibility of the final design engineer.*

5) The plans do not show the location of any of the junction structures. Please indicate these in the plan and profile views.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the entire contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

6) The profile views should include the locations of all crossing utility lines. In those cases where the elevations of the utilities are not known, and the utilities cross the proposed storm drain, they should be noted as such.

> *All utility lines, with the exception of services, are shown in the profile in their approximate location.*

Comments from Afshin Ahouraiyan:

General

1) The flows used in the STORM Plus program do not match the flows form the HEC-1 models. The flows should be the same between the two programs.

> *Due to the iteration process, the updated HEC-1 flows did not make it to the STORM Plus design for the draft submittal. All flows match in the final submittal within 10%.*

2) The routing cards in the proposed conditions should reflect the proposed structures. An example is that the HEC-1 model utilizes trapezoidal shapes for the routings of the flow in Oak Street, whereas the proposed structure is a pipe system and, therefore, should have circular configuration in the routing card. This is the same case for the system in 66th Street.

> *Some reaches have routing both in pipes and in the street. Comment cards have been added to the model to better explain this. Street flow is modeled as a trapezoid and pipes as circular conveyances. All routing reaches and conveyance mechanisms have been rechecked to verify that the proposed structures are reflected in the model.*

Technical

1) The flow splits used in the HEC-1 model after the detention basins for the Osborn Road improvements need to be explained. An analysis is required as to how these values are calculated.

> *All backup calculations for the detention basins are provided in this report. In general, flow splits were sized by the outlet works at each basin. In the HEC-1 model, diversion cards were used where Qpip is the flow leaving the basin in a pipe and Qspl is the flow that spills over the top of the basin and sheet flows over land. Comment cards have been added to the model to better explain this.*

2) It is recommended that the three hydrograph flows at 66th Street are added first and then the 10-year flows diverted in the pipes.

> *There are two types of flow going east on Oak St. at 66th St., pipe flow and street flow. When the street flow reaches 66th St. it is combined with street flow from the north and the combined flows are conveyed in the street south to the Auto Park. The Auto Park basin outlets to a pipe flowing north that is then combined with the pipe flow in Oak St. These combined pipe flows are then routed east along Oak St. to Indian Bend Wash. Comment cards have been added to the model to better explain this.*

3) Explain in the model that the culverts out of the Auto Mall detention basin under, McDowell Road will be plugged up at both ends during the construction phase of this project.

> *A comment was added to the model, there is also a note to that effect on the plans.*

4) I also request that a meeting be set up with the consultants' hydrologist as the logic behind the hydrology modeling for the area after the Paiute Park Detention Basin for the Osborn Road proposed improvements is difficult to follow.

> *A meeting was held on 9/9/97 and these questions were addressed.*

Comments from Raj Shah:

General

1) The removal of existing pipe will be expensive due to large pipe sizes. There are so many utilities involved and the trench excavation will be almost vertical. Also, with the new regulation of backfilling the trench up to top of pipe with 1 sack slurry backfill, the contractor will not know how hard that slurry backfill is around the existing pipe, so the contractor will bid higher for removing existing pipes.

> *The design calls for the utilization of the existing pipe at locations where it is possible and the existing pipe has the required capacity. The alignment has been adjusted to minimize existing pipe removal. Where existing pipe is to be removed, the pipe size is generally small and the costs should be determined as part of the final design.*

2) The cost of the pipe installation will increase as the depth of trench increase because the contractor would have to bring special box plates to satisfy OSHA requirements for depths of 20' and more.

> *The Oak Street Alignment has been adjusted to decrease the depth to invert.*

3) The junction structures from pipe to box to pipe will increase the design and construction cost since it will require special design and construction techniques.

> *Cast in place transition structures are often less expensive to construct than pre-cast junction structures. Boxes were used when required to avoid existing utilities.*

4) The manhole construction for the 20' or deeper pipe may have to be special design.

> *Alignments have been adjusted to minimize the depth to invert where possible. Special design if needed should be addressed in the final design.*

wrong

5) The manhole construction for the dual box culvert will increase the project cost. The equivalent single pipe size would require only one manhole and cheaper to construct.

> *Box culvert has been used where cover is insufficient for pipe.*

6) The double box culvert will require openings every so many feet to equalize the flow. This will require a special design.

> *This comment should be addressed in the final design.*

7) The month dry-out period may increase the cost of pipe installation.

> *The contractor has the option of boring under the canal when it is in use or removing and replacing the canal. The final designer and the contractor should coordinate with SRP.*

8) At pedestrian bridge, low clearance and side slope at IBW outlet will increase cost of removing 84" pipe through that vicinity. The contractor may take a risk of jeopardizing the bridge pier.

> *The District has directed that the Osborn Road outfall shall be designed for the 10-year design storm and connected to the existing storm drain. Therefore, this comment is no longer an issue.*

9) The channel grading will be necessary from pipe outlet at IBW and Osborn Road to elevation below 1210' to daylight the storm drain.

> *The District has directed that the Osborn Road outfall shall be designed for the 10-year design storm and connected to the existing storm drain. Therefore, this comment is no longer an issue.*

Osborn Road Storm Drain Outfall

1) Consideration shall be given to utilizing existing 84" and 72" pipes that are already in ground from Civic Center Blvd. To Indian Bend Wash. The following are some of the obvious cost savings related to using existing pipes:

   Do not have to demolish and construct existing outlet structure.

   Do not have to install new 102" RCP

   Do not have to purchase additional TCE or r/w

   Do not have to disrupt traffic on Osborn Road, Miller Road, 75th Street, and Civic Center Blvd.

   Do not have to relocate any utilities, especially fiber optic cables for hospital.

   Do not have to disrupt traffic to Scottsdale Memorial Hospital and Baseball Stadium.

   Do not have to jeopardize pedestrian bridge structure at the outlet structure.

   Do not have to abandon existing 8'X5' RCB, 84" pipe and 72" pipe.

   Do not have to demolish existing pavement.

   Do not have to disconnect and re-connection the existing lateral storm drain connections.

   Do not have to re-grade channel at Indian Bend Wash (IBW) outlet. (From pipe outlet to daylight elevation of 1214).

   > *Consideration has been given to utilizing the existing storm drain in Osborn Road, from Civic Center Blvd. to Indian Bend Wash. Each of the above benefits demonstrate that utilizing the existing storm drain would translate to cost savings. However, it should be noted that the existing storm drain does not have the capacity to convey the 10-year event for the entire basin.*

2) The alternate basin site shall be evaluated if the Paiute basin does not have adequate capacity to store enough flow to reduce the peak in order to utilize the existing 72" and 84" pipe east of Civic Center Blvd. The alternate should evaluate the cost of purchasing additional basin site versus cost of removing and replacing the existing 72", 84" pipes and 7' X 5' box culvert and other costs associated with it.

   > *The District has directed that the Osborn Road outfall shall be designed for the 10-year event and connected to the existing storm drain. The 10-year storm drain and basin system will be designed as before the change was made. The District and the City of Scottsdale will determine the final design.*

3) Since the cost of an additional basin and removing and replacing existing pipe is extremely high, City of Scottsdale should accept the lesser frequency storm drain due to the downstream pipe constraint. The consultant shall analyze the design frequency (i.e., 2-yr, 10-yr, etc.) related to utilizing the existing 72" and 84" pipes east of Civic Center Blvd. City of Scottsdale shall consume the increment cost of upgrading pipes or accept a lower frequency storm drain.

   > *Analysis of the existing storm drain has shown that it will provide approximately 2-year protection over the entire study basin. The District has directed that the Osborn Road outfall shall be designed for the 10-year design storm and connected to the existing storm drain. Slope constraints dictate that a portion of the existing system be replaced with the new storm drain.*

4) Show any additional rights-of-way or TCE may need to be purchased to construct the storm drain.

   > *Drainage easements are identified surrounding the structures. Larger temporary construction easements are also identified.*

5) The conflicting utilities shall be avoided by adjusting the pipe profile. The consultant has reduced the pipe sizes to avoid the utilities. This may not be an hydraulically good approach. Try to adjust the upstream and downstream storm drain profile to avoid the utilities.

> *Consideration has been given to the vertical alignment with respect to existing utilities. Existing sewer lines have been given the highest priority. Additional conflicts will be resolved by relocating the utility. Costs associated with relocating existing utilities within a zone of influence as defined in the body of the report have been accounted for in the utility budget. The final design should include coordination of adjustments in the storm drain alignment with the utility owners. The plans show the hydraulic grade line, including any constriction and transitions, such that it meets the District's criteria.*

6) From Sta. 52+00 to Sta. 84+00, keep the pipe north of the existing pipe to avoid removal cost of existing pipes.

> *At locations west of station 64+00, the recent installation of an APS electric conduit and underground facilities reduces the space between it and the sewer line such that placing the required pipe would almost certainly require replacement of the utility boxes.*

7) From Sta. 72+50 to Sta. 92+00, change the pipe profile to avoid the 8" SS. If you adopt the comment #6, we may not have to worry about crossing this 8" SS at Sta. 81+.

> *At locations west of station 64+00, the recent installation of an APS electric conduit and underground facilities reduces the space between it and the sewer line such that placing the required pipe would almost certainly require replacement of the utility boxes. Since adequate space between the underground vault and the sewer does not exist at 70th street, crossing to the north side would require one additional sewer crossing.*

8) Provide length of curve, radius and degree of curve at each of the curve.

> *Curve information has been placed on the plans.*

9) At Sta. 112+, the box culvert is very close to the foundation of the transmission tower. Please check.

> *The road along the 64th Street alignment is being designed by Parsons Brinkerhoff. The utility should be relocated or alignment shall be adjusted in final design if necessary.*

10) Evaluate lowering the Paiute Park basin by another 6" to 12" to provide additional storage and also to provide lower pipe outlet elevation of the pipe at Sta. 106+45. By lowering this evaluation and adjusting the pipe slope upstream, we may be able to avoid the 8" SS at Sta. 127+. Or recommended solution would be to adjust the profile without changing pipe diameter to avoid the 8" SS line. The other solution is to cut and plug the sewer line at Sta. 127+ and connect the north portion with the SS line shown north of the storm drain at Sta. 133+. Please check.

> *Paiute Park basin has been lowered to create additional storage. The profile has been adjusted to minimize depth to invert while meeting cover requirements.*

11) What is the purpose of the 3' staggered retaining wall around north and south side of detention basin? Why not callout 3' straight retaining wall?

> *The staggered retaining walls have been replaced with a straight retaining wall.*

12) Since we have 5' or more of cover, Sta. 115+ Sta. 122, why not use pipe instead of box culvert? The pipe is hydraulically more efficient, cheaper and easier to install than a box culvert.

> *The box culvert has been replaced with a pipe from Station 117+00 to Station 122+. From station 115 to 117 a box culvert is needed due to cover restrictions.*

13) Provide a low flow channels or pipes (swales) inside both of the detention basins so that for smaller events, the flow will not inundate ball fields.

> *There are no recreational uses proposed in the Marriott basin. The soccer field in Paiute Park is protected by a pre-treatment basin to the west. This will avoid flooding of the field during small events. These conceptual grading plans should be detailed during final design.*

14) Is the SS manhole shown on Paiute Park DB watertight?

> *As this is a planning document and not construction plans, the manhole design shall be determined during the final design.*

15) Identify the rights-of-way needed at the Marriott Garden Homes DB to modify the grading.

> *A drainage easement is identified surrounding the basin. A larger temporary construction easement is also identified.*

Oak Street Storm Drain Outfall

1) The storm drain box culvert is extremely close to the 18" IRR line, and 18" waterline. One or the other may need to be relocated.

> *The storm drain alignment leaves as much space as possible between parallel utilities. Costs associated with relocating existing utilities within a zone of influence as defined in the body of the report have been accounted for in the utility budget. The final designer and the contractor should coordinate with the utility owners.*

2) The box culvert size downstream of Sta. 28+, at few locations does not meet District's HGL criteria.

> *Box sizes and invert elevations have been adjusted to meet the District's criteria.*

3) To avoid 18" IRR, at Sta. 24+, we may have to remove 18" W and upgrade 8" W to 24" W and shift the storm drain north, away from 18" IRR. Please check.

> *The storm drain alignment leaves as much space as possible between parallel utilities. Costs associated with relocating existing utilities within a zone of influence as defined in the body of the report have been accounted for in the utility budget. The final designer and the contractor should coordinate with the utility owners.*

4) From Sta. 43+, the storm drain is extremely close to the 20" W. The solution would be to either protect in place 2" G and shift the storm drain south to keep it away from 20" W. Please check.

> *The wide box culvert has been replaced by a single pipe (see next comment). Adequate spacing now exists in this area. Costs associated with relocating existing utilities within a zone of influence as defined in the body of the report have been accounted for in the utility budget. The final designer and the contractor should coordinate with the utility owners.*

5) From Sta. 43+, use single pipe then a double box culvert because it will be easy to install pipe than double box culvert and also, it is cheaper to build one manhole than a double manhole. The double box culvert would require a flow equalizing openings every so many feet to keep the flow equal on each box. This will increase construction cost. The pipe is more efficient and cheaper to construct. Also, the junction box at Sta. 81+00 would be cheaper and easier to build for the pipe. Also, if for any reason jacking/boring were the preferred construction method to be chosen to pass under the cross cut canal, then pipe would be much cheaper.

> *A single pipe has been designed for the portion of the Oak Street outfall between 43+00 and 73+00. A box culvert Is recommended for use under the canal due to cover restrictions.*

6) From Sta. 53+, the storm drain is extremely close to 20" W and 24" IRR Lines. The solution would be to relocate 2" G line and keep the storm drain on south half of the Oak Street.

> *The wide box culvert has been replaced by a single pipe (see previous comment). Adequate spacing now exists in this area. Costs associated with relocating existing utilities within a zone of influence as defined in the body of the report have been accounted for in the utility budget. The final designer and the contractor should coordinate with the utility owners.*

7) At Sta. 81+00, why is the storm drain 25' deep? The lateral coming from south of 66th Street can also be raised at least 5' to 6'. Please consider changing the profile upstream and downstream of Sta. 81+00 to bring the storm drain close to 20' depth.

> *The Oak Street Alignment has been adjusted to decrease depth to invert where possible. The inverts of both the lateral and main line have been raised approximately 6 feet.*

8) Please bring the 66th Street lateral at some radius instead of 90 degree.

> *A 90.00' radius has been applied at 66th Street. Additional costs will be incurred due to the replacement of the sidewalk and waterline.*

9) Change the pipe and box sizes to next bigger size that is widely available and does not require special design.

> *Although the pipe sizes are commercially available according to Ameron, Inc., they are not usually held in stock. Thus, they would be more expensive. Pipes will be designed with 6 inch increments where possible. In some locations, hydraulics dictate an odd size so that hydraulic jumps and high velocity supercritical flow can be avoided.*

10) Evaluate reducing the slope of pipe from Sta. 82+00 to 94+00. This will bring the storm drain a few feet higher and reduce some excavation and at same time use pipe capacity more efficiently. The pipe is shown partially full.

> *The Oak Street outfall has been adjusted to decrease depth to invert where possible.*

11) Also, reduce the slope of the lateral coming in at Sta. 94+00.

> *The Oak Street outfall has been adjusted to decrease depth to invert where possible. The invert of the 64th Street lateral has been raised approximately 1.5 feet.*

12) At Sta. 121+, the storm drain is encroaching into the Arizona Army National Guard's rights-of-way. Also, the storm drain crosses two waterlines around this location. Evaluate re-directing storm drain at Sta. 120+00 toward the north half of the street. This will avoid purchasing additional rights-of-way and avoid the utility conflict.

> *The angle point of 121+32.78 has been moved east so that the storm drain lies completely within the right-of-way. A temporary construction easement is also identified.*

13) At Sta. 130+00, identify additional rights-of-way needed to construct the inlet structure and storm drain.

> *A proposed drainage easement is identified surrounding the structure. A larger temporary construction easement is also identified.*

14) At Hubble Street, identify additional rights-of-way needed to construct the inlet structure and storm drain.

> *A proposed drainage easement is identified surrounding the structure. A larger temporary construction easement is also identified.*

15) Evaluate reducing the slope of the 66th Street lateral. This will reduce the excavation cost and also, utilize the full capacity of the pipe. The junction of Oak Street main line with 66th Street lateral is shown 25' deep. Please check.

> *The Oak Street outfall has been adjusted to decrease depth to invert where possible. The invert of the 66th Street lateral has been raised approximately 6 feet.*

16) At the Auto mall basin, identify rights-of-way needed to modify the basin grading.

> *A proposed drainage easement is identified surrounding the structure. A larger temporary construction easement is also identified.*

Comments from Richard Harris:

Hydraulics

1) Based on the plans, the outlet elevation of the Oak outfall at the IBW (1206.5') is lower than the adjacent existing ground (1209.8', est.). To ensure positive drainage, a channel will need to be constructed from the outlet to a point within the IBW which is lower in elevation than the outlet. Please address.

> *The invert specified on the plans matches the invert of the existing structure. No changes have been made to the grading of Indian Bend Wash.*

2) Based on the plans, the outlet elevation of the Osborn outfall at the IBW (1214.6') is lower than the adjacent existing ground (1222.0', est.). To ensure positive drainage, a channel will need to be constructed from the outlet to a point within the IBW which is lower in elevation than the outlet. Please address. The current plan does not show any elevation contours within the IBW which are low enough.

> *The invert specified on the plans matches the invert of the existing structure. No changes have been made to the grading of Indian Bend Wash.*

3) When the beginning tailwater for the Oak outfall is made 2' higher than the soffit elevation, per FCD analysis of the IBW during concurrent flooding, the calculated HGL at the Miller Road manhole is above the ground, and this condition extends over 1000' up-drain. However, this condition is not carried into the region of the Auto mall basin since the calculated HGL elevation at that point is 1267.21', below the basin rim. Consider increasing the <u>pipe</u> size of the 66th Street lateral in order to save money (over the box culvert listed in the STORM Plus model), and meet both the FEMA and storm drain project design criteria. Further cost savings could be realized if the transition at Station 82+29 (STORM Plus ID) were moved downstream to a point below the junction, and the manhole at Station 81+00 moved upstream to the junction of the main pipe and the 66th Street lateral. By doing this the type of junction needed could be changed from "special design junction box" to a regular junction box, saving nearly $30,000.00.

> *The box culvert in 66th Street has been removed, and replaced with a smaller diameter pipe, due to the capacity increase in 64th Street. The junction at 82+29 represents flows into the system west of the intersection of 66th Street and flows from the north side of 66th Street. Moving the junction to the east side of the intersection would raise the HGL in the lateral and would not accurately demonstrate flows into the system from the north and east.*

4) The invert elevation of the connector pipe at Station 15+01.52 on Sheet 3 is 1' lower then the respective invert in the STORM Plus model. Please rectify.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as junctions in the STORM Plus file. Since the storm drain is designed for the capacity in basin, these may be future connections to the storm drain and are not shown on the plans. The overflow lateral from the irrigation structure is not the junction shown in STORM Plus, as no storm water is conveyed in the irrigation line.*

5) Between the Oak Street Main Line STORM Plus model, Stations 67+77.26 and 74+18.13, there is only 1 manhole per the plans, not 3 as shown on the model. Please correct.

> *All STORM Plus cards give the upstream station of the element. Therefore the three manholes refer to the element between 57+36.03 to 67+77.26. The plans and model have since been modified to reflect design changes.*

6) For the STORM Plus model oak6100.dat, the section number for Station 95+02.68 should be 5 per the plans, not 4. Also the number of manholes should be 2. Please correct.

> *All STORM Plus cards give the upstream station of the element. Therefore the cross-section id from 94+11.76 to 95+02.68 should be a 4 and the number of manholes should be one. The plans and model have since been modified to reflect design changes.*

7) Per the plans for the Oak Main Line, the first 1800' long segment of the box culvert should be modeled using Section 2, not Section 1. Please correct.

> *The plans have been modified to reflect the proper box sizes.*

8) Although the goal for the proposed design is to provide subcritical flow conditions throughout both systems, the output of the Oak Main Line shows supercritical flow at several locations and hydraulic jumps occurring at two locations. Please address potential flow instability in the design.

> *The updated hydraulics show only a very small portion of the system is supercritical flow. Where final design velocities exceed 20 ft/sec, the District should specify additional cover on the concrete reinforcement.*

9) Per the plans for the 66th Street lateral, the first 2150' segment of the system is a 54" pipe, not a box culvert as modeled. Please rectify both plans and model. Also, the number of manholes at station in the model should be corrected as follows: 1 manhole at Station 20+31.69; 2 manholes at Station 21+90.27; 1 manhole at Station 26+70.00.

> *The box culvert in 66th Street has been removed, and replaced with a smaller diameter pipe, due to the capacity increase in 64th Street. All STORM Plus cards give the upstream station of the element. The model has been changed to reflect the proper number of manholes. Since manholes can not be placed on junction cards, manholes are placed on the nearest reach. The plans and model have since been modified to reflect design changes.*

10) Per the plans for the Osborn outfall, the model should be revised to include JX record for the 42" pipe proposed near Station 12+60, Sheet 21.

> *The design has been updated to use the existing storm drain east of Miller Rd, therefore this comment is no longer applicable.*

11) It is unclear why there is an extremely short modeled reach within osb6100.dat which uses 5' X 16.75' box culvert (without a pier) between Stations 21+30.29 and 21+31.00. Please explain.

> *The design has been updated to use the existing storm drain east of Miller Rd, therefore this comment is no longer applicable.*

12) Per the plans, the size of pipes shown near Station 24+89.78, Sheet 22 of the Osborn Drain are 54" and 42". These do not match the 2' diameter pipe modeled for that location. Why weren't the larger pipes modeled?

> *The model has been updated to reflect a junction at 25+03.78 with the 54" and the 42" storm drains from the north.*

13) The Osborn model has a JX record at Station 31+47.51 for a 4' diameter pipe, while the plans (sheet 23) show an 18" pipe there. Please rectify.

> *The model has been updated to reflect a junction at 31+55.73 with the 18" storm drain from the south.*

14) On Plan Sheet 23 there is a proposed 42" RCP shown joining the Osborn outfall near Station 36+15.00, yet the STORM Plus model does not have a JX record to reflect it. Please rectify.

> *The model has been updated to reflect a junction at 36+32.77 with the 72" existing storm drain.*

15) The Osborn model has a JX record at Station 38+35.00 for a 4' diameter pipe, while the plans (Sheet 24) show a 5' pipe near there. Please rectify.

> *The model has been updated to reflect a junction at 38+32.29 with the 60" existing storm drain. Where laterals do not intersect vertically, a small portion of proposed connector pipe is shown.*

16) The Osborn model should be revised to include the 2 manholes shown on the plans between Stations 47+10.00 and 38+60.00 (Sheets 24 & 25). Also, there are not manholes between Stations 48+99.45 and 47+10.00.

> *The model has been revised to reflect the correct manhole numbers.*

17) The beginning tailwater used for the storm drain upstream of the Paiute Park Basin (model osbs6100.dat) should equal the headwater at the inlet of the pipe which empties the basin (model osb6100.dat) elevation 1256.4'.

> *The tailwater for the south portion of the Osborn storm drain begins at the peak of the basin.*

18) Per the plans for Station 81+71.33, Sheet 28, the Osborn model should be revised to account for a transition section there.

> *All STORM Plus cards give the upstream station of the element. The transition structure is shown by a TS card now at station 81+79.55.*

19) The plans show a 36" RCP between Stations 81+71.33 and 82+02 on Sheet 28, while the STORM Plus model shows a 3.5' X 5' box. Please clarify so that the plans and the model agree.

> *The plans have been changed to reflect the model which shows a 3' x 8.5' box from station 81+79.55 to station 82+10.55.*

20) Per the plans for Station 90+20.00, the Osborn model should be revised to reflect the invert elevation shown on the plans, or vice versa. Please clarify so that the plans and the model agree.

> *The plans have been changed to reflect the invert elevations in the model.*

21) The plans show a 42" RCP between Stations 90+20 and 90+50 on Sheet 29, while the STORM Plus model shows a 3.5' X 5' box. Please clarify so that the plans and the model agree. Also, the plans show a 36" RCP between Stations 90+20 and 90+50 on Sheet 29, while the STORM Plus model shows a 3.5' X 5' box.

> *The plans showed a 42" RCP between stations 90+20.00 and 90+50.00 on sheet 29. This has been changed to a 3.5' x 5' box per the model. A 36" RCP between stations 90+20 and 90+50 was not found on sheet 29.*

22) There is a JX record in the STORM Plus model at location 123+19.46, although there is nothing shown on Plan Sheet 32 to reflect any proposed or existing structures. Please rectify.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as junctions in the STORM Plus file. Since the storm drain is designed for the capacity of the contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

23) Per Sheet 32 of the plans, there should be a manhole added to model osbs6100.dat between Stations 123+69.46 and 127+30.00. Also, the two manholes shown in the model at Station 127+72.58 should be removed from the model.

> *The model has been revised.*

24) The 48" RCP shown on the plans extending upstream from Station 123+96.46, Sheet 32, is modeled as a box. Please clarify so that the plans and the model agree.

> *All STORM Plus cards give the upstream station of the element. The structure upstream of station 123+69.46 is modeled correctly as a 48" pipe. The plans and model have since been modified to reflect design changes.*

25) The plans show a 8' X 3.5' box culvert between stations 127+72.98 and 127+85.00, Sheet 33, while the STORM Plus model shows a 3' X 4.5' box. Please clarify so that the plans and the model agree.

> *The plans have been revised to show a 4.5' x 3' box between stations 127+50.00 and 127+85.00. The model and the plans agree.*

26) The total width of Section Number 2 as listed in the Osborn model is 2' wider than that shown on the plans. Please rectify.

> *The plans and model have since been modified to reflect design changes.*

Report

1) Figure 2-2 should be revised to reflect the alignment of the Osborn Drain down Catalina Drive.

> *The figure has been revised.*

2) Figure 2-2 should be revised to reflect that no section of drain above the Paiute Park Basin is currently proposed as "Open Channel".

> *The figure has been revised.*

3) To improve clarity in the report text, the last paragraph on page 3-6 and the one above it should be switched.

> *The report has been revised.*

4) The unit cost of rebuilding sidewalk (shown on Table 3-3) is closer to $12.00 per linear foot (estimated @ $4.00/sf).

> *Since the sidewalk in the Auto Park basin is 10' wide we have used a more conservative estimate which equals $40.00 per linear foot.*

Plans

General

1) A note should be included in the plans stating that, "all utilities will be protected in place, unless otherwise noted on the plans".

> *Although the plan set is not intended to be a construction document, the comment has been added.*

2) It is not clear from the plans were the location of most of the junction boxes are, since their locations (found by STORM Plus) on the plans show either a "manhole", a "transition", or simply a small pipe connected to the main pipe. Where junction boxes and special junction boxes are indicated by the STORM Plus model, they should labeled and the joining drain should be on shown the plans, with the proposed invert elevation, size and direction of approach towards the main pipe labeled.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the capacity of the contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

3) The 8' - 10' lengths of the outlet structures shown for both outfalls at the IBW do not suggest adequate length for energy dissipaters. It would be useful if these structure sizes were estimated and drawn more representatively in order to better estimate needed ROW and identify potential conflicts.

> *We believe that these considerations should be addressed in the final design stages. We have included allowances in the cost estimate for improvements at the exit to the conveyance and easements where necessary. Since we are designing for connection to the existing structure in the Osborn alignment, additional easement for the outlet works is not necessary. Since the City of Scottsdale owns the property at the outfall of the Oak Street alignment, additional easement for the outlet works is not necessary.*

4) Show existing lateral pipe inverts for all those pipes which will be joined to a proposed trunk line. Also, all laterals identified in the models must be shown on the plans.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the capacity of the contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

Oak Street Outfall

1) While the cost estimate shows a total of 13 manholes and 19 junction boxes for the Oak outfall, I counted 35 manholes and 9 junction boxes per the STORM Plus model (not counting what appear to be "double" manholes where the drain is a double box). The unit cost for a junction box is seven times greater than a manhole. The cost estimate should be revised.

> *The cost estimate has been updated to separate costs for junction structures, transition structures and manholes. The plans and model have since been modified to reflect design changes.*

2) Wherever overhead power or telephone lines cross the proposed alignment, a caution note is needed on the plan.

> *As this is a planning document and not construction plans, construction notes should be the responsibility of the final design.*

3) The plans should show the size, depth, and type (e.g., DIP vs. ACP) for all potentially conflicting utilities in order to better determine which will need replacing rather than protecting in place.

> *The profiles have been updated to reflect approximate vertical alignment and properties where information is available. Potholing of existing utilities before construction is recommended.*

4) The slope calculated from the elevations shown on the plans between Stations 30+53.65 and 29+80.65 is closer to 0.0008 ft/ft. Please re-label the plans or change the STORM Plus data.

> *The plans have been corrected to reflect the correct invert at station 32+50.*

5) Any proposed connector pipes such as that shown near Station 36+30 should be at least 15" in diameter. Please rectify.

> *This has been rectified on the plans.*

6) Since the Oak outfall between 66th Street and Scottsdale Road is quite deep, a pipe alternative to the proposed box should be considered to save money.

> *A single pipe has been designed for the portion of the Oak Street outfall between 43+00 and 73+00. A box culvert is recommended for use under the canal due to cover restrictions.*

7) The 20" water main which runs within 2' of the proposed Oak outfall from Station 43+00 to Station 55+50, and then across the alignment from 55+50 to 57+00, must be identified as to the type of material which it is made of in order to be determined if special considerations must be made during construction.

> *The pipe in question is a concrete pipe per Scottsdale water maps. Potholing of existing utilities before construction is recommended.*

8) A note is needed on the Oak outfall plans stating to relocate or protect in place the 2" gas line shown running within 2' of the south edge of the drain between Stations 41+80 and 55+20.

> *The wide box culvert has been replaced by a single pipe (see previous comment). Adequate spacing now exists in this area.*

9) Show existing benchmarks located throughout the study area. It would be useful to have those which fall within the plans shown and described.

> *As these plans are a planning document and not construction plans, benchmark information shall be the responsibility of the final design engineer. The report specifies the datum for the topographic information used in this study.*

10) Pipes sized 33" and 57" are atypical and not commercially available. The next larger sizes should be used.

> *Although the pipe sizes are commercially available according to Ameron, Inc., they are not usually held in stock. Thus, they would be more expensive. Pipes will be designed with 6 inch increments where possible. In some locations, hydraulics dictate an odd size so that hydraulic jumps and high velocity supercritical flow can be avoided.*

11) Under the current design, the 66th Street Lateral STORM Plus model 66th6100.dat, uses a box culvert to model flows from Station 10+00 to Station 21+57.25, while the plans show a 54" pipe for that reach. By running the model with the 54" pipe it is evident that the plans must be mislabeled. Please correct.

> *The box culvert in 66th Street has been removed from the STORM Plus file, and replaced with a smaller diameter pipe, due to the capacity increase in 64th Street. The box culvert was significantly oversized as evidenced by the receding margin between the HGL and the box culvert flowline. The 54" pipe is undersized, therefore a 72" pipe has been replaced.*

12) By comparing contour lines shown on the plan near the inlet of the 64th Street lateral with the inlet elevation of the pipe, it looks like there will be over 8' drop into the pipe entrance. Special inlet considerations, such as a grouted rip-rap apron or other stabilization will be needed to prevent head cutting. A similar condition seems to exist at the inlet of the Osborn main pipe, Station 130+95 (6' drop). Please address both.

> *We concur with the fact that special inlet considerations will be needed at the inlet to the 64th Street lateral and we believe that these considerations should be addressed in the final design stages. We have included allowances in the cost estimate for improvements at the entrance to the conveyance and have shown a drainage easement around the entrance to allow for the construction of any improvements.*

Osborn Road Outfall

1) While the cost estimate shows a total of 7 manholes and 21 junction boxes, I counted 30 manholes and 13 junction boxes per the STORM Plus model (not counting what may be "double" manholes where the drain is a double box). The unit cost for a junction box is seven times greater than a manhole. Please review the cost estimate or rectify otherwise.

> *The cost estimate has been updated to separate costs for junction structures, transition structures and manholes.*

2) The temporary construction and permanent drainage easements needed immediately above the outlet of the Osborn Drain should be shown on the plans.

> *The District has decided to use the existing storm drain at this location and no easements will be required for the recommended plan.*

3) Transition sections for the Osborn outfall shown in plan view between Stations 17+78 to 18+27 and 24+13 to 24+33 do not reflect the stations in profile and what was used in the STORM Plus model. Please rectify.

> *The design has been updated to use the existing storm drain east Miller Rd., therefore this comment is no longer applicable.*

4) Note number 5 on Sheet 22 says "connect existing lateral to storm drain", and note number 16 which is immediately upstream says, "plug existing storm drain". Please explain.

> *The design has been updated to use the existing storm drain east Miller Rd., therefore this comment is no longer applicable.*

5) The 2' diameter lateral modeled in the STORM Plus model at Station 22+25.00 should be labeled on the profile, Sheet 22.

> *The design has been updated to use the existing storm drain east Miller Rd., therefore this comment is no longer applicable.*

6) The proposed 42" and 54" RCP's shown on Sheet 22 are existing in plan view. Are they labeled proposed to reflect alignments changes? Also, it would be helpful if you listed all proposed pipes as a certain length of new pipe on the plans in order to further substantiate the cost estimates.

> *A small section of each of the pipes will need to be constructed to connect the existing pipe to the storm drain, which is at a lower invert than the original connection.*

7) For the existing and proposed storm drain alignments shown at 75th Street and Osborn Road, a special structure may be needed at their junction. If not, then the manhole located at Station 30+00 should be moved at Station 31+47.

> *The laterals at 75th Street are relatively small diameter and can be connected to the proposed storm drain by conventional methods.*

8) The proposed 60" RCP shown at Station 38+50 should be moved so that it does not join the main pipe within a transition section (the location of this feature per STORM Plus is actually Station 38+35).

> *The lateral can be connected to the proposed storm drain by conventional methods. Otherwise, the lateral would need to be protected in place while the box is constructed beneath. The water then would flow into the storm drain at 36+32.77.*

9) If it can be assumed that the connector pipes shown on the plans at Stations 43+38, 44+84, and 46+50 will be joined to the trunk line at 90 degree angles, then these connections need to be accurately shown on the profile at the same locations. Please correct or otherwise substantiate.

> *The approximate location of the pipes is shown in the profile. A small section of each of the pipes will need to be constructed to connect the existing pipe to the storm drain, which is at a lower invert than the original connection.*

10) The proposed 48" RCP shown at Station 46+93 is not modeled in the STORM Plus model. Please correct.

> *The storm drain from Brown Ave. is now modeled.*

11) Due to the close proximity of the 8" sewer to the proposed manhole at Station 50+85.47, a better location for the manhole would be at the junction of the trunk line with the proposed 66" RCP at Station 51+15.

> *Final manhole placement should be decided in the final design.*

12) The STORM Plus model shows a 42" pipe where the 66" lateral pipe is shown on the plans at Station 51+15 (Sheet 25). Please rectify.

> *The model has been revised.*

13) Note number 8, which points to the trunk line at Station 51+36, is not listed in the notes section on the plans. Please add.

> *The plans have been revised to reflect changes in the notes section.*

14) A note is needed for the existing 72" storm drain regarding plugging it where it will be abandoned, and removing it where it conflicts with the proposed system on Sheet 25. Also, due to anticipated construction problems with the new system and in order to save money and reduce right-of-way problems, the existing system from Civic Center Blvd. east to the IBW should be considered as a preferred design alternative.

> *See notes 4 and 5 (formally 16 and 18) on the plan sheet.*

15) There is an unidentified small box structure located at Station 52+08 where the proposed storm drain alignment is shown. The box is connected to a telephone line issuing from a telephone box. Please identify both structure and intent.

> *The box is a telephone manhole.*

16) The location on the plans where the note "Exist 24" RCP to remove (typ.)" does not make sense. First, that location does not need removal and second, the idea of a typical removal is not adequate. Also, note number 4, located at Station 56+24, is not listed in the notes section on Sheet 25. Please add. Removals should be shown as to extent (and it would be helpful if noted by length) throughout the project. Please correct.

> *The plans have been revised to reflect changes in the notes section. Removals are called out, however, quantities are the responsibility of the final engineering design.*

17) Per the osbs6100.dat model, there will be a 5' pipe near Station 57+82.00. Please show on the plans.

> *The model has been revised and this comment is no longer applicable.*

18) The size of utilities and a note regarding intent for them is needed at the following locations: telephone, Station 57+83; gas, Station 60+08; gas, Station 63+08; sanitary sewer, Station 64+40. Please add.

> *The plans have been revised.*

19) The STORM Plus model shows a 54" lateral pipe at Station 64+30.69, which when located on the plans is at the joint between a transition section and an 84" RCP. One or the other should be moved.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the entire contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

20) The existing 8" sewer shown in profile at Station 72+32 will need to be encased due to its apparent close proximity to the storm drain.

> *The sewer will not be encased as it will be changed to DIP per the City of Scottsdale direction.*

21) The note to plug the existing storm drain at Station 77+16 does not make sense since the existing drain at the location will be removed.

> *The plans have been modified.*

22) The STORM Plus model shows a 72" lateral pipe at Station 77+43.12, which when located on the plans is at the joint between a transition section and a 78" RCP. One or the other should be moved.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the entire contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

23) The STORM Plus model shows a 42" lateral pipe at Station 87+49.69, which when located on the plans is at the joint between a transition section and a 66" RCP. One or the other should be moved.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the entire contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

24) The estimated volume of excavation required for the Paiute Park Basin should be substantiated with cross-sections and calculations in the report. My estimated volume was nearly 30% less, which would yield a savings of around $50,000.00

> *The basin volume calculations have been updated. The final design of the basins, including cross-sections, should be done in final design.*

25) The depth of the 10" sanitary sewer shown running along the bottom of the Paiute Park Basin should be investigated to determine if the sewer needs encasement, replacement, or nothing.

> *The sewer has been located on the plans. If necessary, the final design engineer should specify replacement with DIP per direction from City of Scottsdale.*

26) A note for the telephone crossing of Osborn near Station 90+50 needs to be added to the plan.

> *The plans have been updated to reflect a total of four crossings at this location.*

27) When the correct beginning tailwater is used for the segment of the Osborn Road outfall which empties into the Paiute Park Basin (see related comment under "Hydraulics"), the upstream HGL elevation is raised so that the design criteria (of 1' below ground for the HGL) is not met around the proposed manhole at Station 111+00 (where the HGL is shown to be at ground level). Also, this manhole is not shown to extend upward to match proposed grade. Please rectify. At the system head works, the HGL elevation was calculated to be 1271.19' which appears to be less than 1' from the top of the basin--this may be less than acceptable depending on design standards.

> *The design has been updated to use the existing storm drain east of Miller Rd, therefore this comment is no longer applicable. See the main body of the report of explanation of the beginning tailwater requirements at the junction with the existing system. The beginning tailwater at 106+11.07 is the peak water surface elevation in the basin.*

28) The 8" sanitary sewer shown near the Paiute Park Basin on Sheet 31 enlarges to 10" on Sheet 30, without connecting lines shown. Please check.

> *The plans have been modified.*

29) The plans show a telephone line crossing the main storm drain near Station 127+60. A note should be added describing intent for the line.

> *The plans have been modified.*

30) The STORM Plus model has a JX record for a 48" lateral pipe at Station 127+75. When located on the plans this pipe would not fit within the proposed trunk line segment. Please clarify.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the entire contributing watershed, these may be future connections to the storm drain and are not shown on the plans. The plans and model have since been modified to reflect design changes.*

31) Per the STORM Plus model, there is a 24" lateral pipe (JX record) at Station 140+10, although there is nothing shown in plan or profile on Sheet 34. Please correct the plan or rectify otherwise.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the entire contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

32) Per the STORM Plus model, there is a 24" lateral pipe (JX record) at Station 145+40, although there is nothing shown in plan or profile on Sheet 34. Please correct the plan or rectify otherwise.

> *Existing and proposed storm drain laterals are shown on the plans. Flow increments in the hydrology show up as additional junctions in the STORM Plus file. Since the storm drain is designed for the entire contributing watershed, these may be future connections to the storm drain and are not shown on the plans.*

33) Per the STORM Plus model, the 42" pipe shown on Sheet 34 extends to Station 148+00 on Sheet 35. Please correct the plan or rectify otherwise.

> *The plans and model have since been modified to reflect design changes.*

34) Due to the proposed 6' depth and 4:1 side slopes of the Marriott Brighton Gardens and the Residential Character or the surrounding neighborhood, I recommend perimeter fencing. Fencing is usually not recommended where side slopes are 6:1 or flatter; for the given depth.

> *Final slopes and fencing to be determined at final design of Marriott Basin.*

35) All basin bottoms should have sufficient labeling to indicate a positive grade towards the outlet of at least 0.005 ft/ft.

> *The plans have been modified.*

36) For the present configuration of the Paiute Park Basin, a low-flow drain should be added between the pre-basin and the main basin outlet to ensure that 3' deep pre-basin will drain within 36 hours. This is recommended since past maintenance experiences in other areas suggest that fine sediments will accumulate and reduce basin infiltration capacities to the point that the basin will not infiltrate, posing a health hazard.

> *The drawdown of the basin should be evaluated at final design. Present design includes the use of infiltration, and If necessary, dry wells since a low-flow drain will not have adequate slope.*

37) For the sediment removal, the pre-basin may be better situated within the Marriott Brighton Garden Basin.

> *The pre-basin in Pauite Park protects the sports field from low occurrence storm events and is not designed for trapping sediment.*

38) The plans should show the proposed location of the entire length of the maintenance access road for the Marriott Brighton Garden Basin, connecting to an existing street.

> *The access road has been outlined on the plans.*

Comments from David Meinhart:

1) Page 2-4: With regard to a potential Letter of Map Revision for the Hy-View neighborhood, we prefer to focus on providing a complete structurally-based solution to the floodplain issue as quickly as economics will allow. For this reason, we would like to see the Conditional Letter of Map Revision process for the recommended solution begin before moving into final design. Any input we can gain from FEMA at the concept design phase should assist us during final design.

   This comment has been addressed in the main body of the report.

2) Page 2-5: We concur with the recommendation to continue pursuing the Smitty's parking lot route as an alternative to the Thomas Road alignment for the upper reach of the Osborn Road outfall.

   Design of this alternative should be considered in the final construction plans.

3) Page 2-7: We support using the existing storm drain in Osborn Road between Civic Center Blvd. and Indian Bend Wash to gain as close to 10-year protection as is possible. Our one concern is that future conditions not be worsened west of Civic Center Blvd. along Osborn Road.

   Modeling of the existing storm drain has shown that the storm drain would provide approximately 2-year protection over the study basin. The Flood Control District has subsequently returned comment that the Osborn alignment shall be designed for the 10-year design storm and connected to the existing storm drain. Negotiations between FCDMC and the City of Scottsdale will determine the final design.

4) Page 3-7: Another issue in the maintenance of traffic flows during construction will involve access to Tonalea Elementary School and Coronado High School. Both of these schools are located along the Oak Street outfall alignment.

   The report has been updated to address these issues.

5) Page 4-1: The recommended Phase I for the Osborn Road outfall proposes all improvements planned for Paiute Park be included in the 64th Street road-widening project between Thomas and Indian School Roads. This project is scheduled to begin July 1998. Additional coordination regarding final design issues and budget implications will need to occur in the near future, if this recommendation is to move forward.

   The phasing plan has been revised to include only the pipe in the 64th street right-of-way for the Osborn Road outfall. Additional coordination between these projects is recommended for final design.

Appendix G - Recommended Plan Correspondence

FLOOD CONTROL DISTRICT

OF MARICOPA COUNTY

Interoffice Memorandum

Land Management Division

Easement Cost Analysis

SUBJECT: STP Papago Regional Flood Control Project

DATE: 6/18/97

TO: Scott Clement, P.E., Project Manager

6/23/97

PROPERTY OWNERS: Various

ANALYST: Al Dickie

The following analysis is a departure from the specific Uniform Standards of Professional Appraisal Practice [USPAP] Guidelines. This analysis meets the minimum requirements as specified in USPAP. It is in conformance with the policies of the Flood Control District of Maricopa County [District], and complies with the District's Minimum Standards. It is not so limited in scope as to mislead.

SCOPE OF ANALYSIS: The scope of this Analysis is to review the STP Papago Regional Flood Control Project Watershed Study and evaluate the estimated easement costs for acquisition.

PROPERTY DESCRIPTION: The Properties ware identified in the Study in Table 4-4 and 4-5.

OVERVIEW OF MARKET CONDITIONS, TRENDS, AND PROJECT, there is sufficient information contained in the report.

APPARENT ADEQUACY AND RELEVANCE OF DATA: The Auto Park Easement Costs were estimated to be $130,000 an acre for 1.5 acres of basin. The Marriott Homes basin site was estimated to be $175,000 an acre for 1.5 acres. The Paiute Park Basin Site was estimated to be $175,000 per acre for 3 acres. The Paiute Park Easement Costs were estimated to be $130,000 per acre for 0.50 acres. The Scottsdale Exec. Villas Easement Costs were estimated to be $130,000 per acre for 2.00 acres.

PURPOSE OF THE ANALYSIS: The purpose of this analysis is to review the value estimates in order for the District to make a probable cost estimate for budgeting purposes.

PROPERTY IDENTIFICATION: Adequate - Areas are described in the report.

NEIGHBORHOOD DATA: N/A

SITE DATA ANALYSIS: Adequate - The report discusses general site conditions.

IMPROVEMENT DESCRIPTION: All parcels are part of developed lands or in exiting alley ways or easements.

HAZARDOUS SUBSTANCES: The analyst does not have sufficient expertise in these fields and recommends that a potential buyer should have environmental studies completed.

HIGHEST AND BEST USE ANALYSIS: Not conducted at this time. Analysis based upon present use.

VALUATION PROCESS: The three methods which are primarily used by appraisers to establish value are the Cost Approach, the Sales Comparison Approach, and the Income Capitalization Approach. However, in this Analysis, the analyst eliminated the Cost and Income Approaches as indicators of value. For the purposes of evaluating the range of possible land costs, the range was based upon Comparable Sales.

CORRELATION OF SALES: This Analyst has not personally viewed the comparable sales used in the Analysis. Notes of the comparable are in the Analyst files. The Analyst has viewed each of the subjects.

FINAL CORRELATION AND CONCLUSION TO VALUE:

The values by the consultant are probably fairly close with one possible exception. The Marriott Homes Basin Acquisition is probably low as the owners may claim some severance issues. The site is probably not fully developed by the floor area ratios allowed by the zoning. They could utilize part of the retention basin for more parking if they wished to more intensively use the facility. The present use has residents who do not need the parking area that, say, an apartment complex would require. They may argue that a deeper, larger basin would preclude any of that area for potential use as additional parking and expansion of the facility. If that is the case, then damages to the whole might be argued. SRP has sold the parcel at the NE Corner of 64th St. and Thomas for $5.14 per sq. ft for Multi-family. The deal is in escrow and closes Aug. 17, 1997. Due to this comperable sale,I believe that a permanent easement for the basin would probably be in the range of $316,700 to $357,500.

The easement behind the Scottsdale Executive Villas, if constructed in the alley way, should not be a cost. There would be a cost for a temporary construction easement, if the Villas land needs to be used.

Because of the sale of the frontage along Thomas at 64th, unless the pipe easement can be contained in the SRP canal right of way, the new owner may have to be dealt with for part of the easement. If SRP requires payment for an easement along the canal to Paiute Basin, then the value by the consultant is probably accurate. If a permanent right is required from SRP for the Paiute Basin, and they want to be compensated, then the amount shown by the consultant is probably accurate. The park is leased to Scottsdale for a nominal amount (like a dollar a year), but the lease is only for approximately 20 years. If a permanent right is needed, I suspect some payment will be required.

ANALYST'S COMMENTS:

Estimate of Acquisition Costs:

Auto Park Basin	$195,000
Marriott Homes Basin	$357,500
Paiute Park Basin	$525,000
Paiute Park Easements	$65,000
Exec. Villas TCE	$26,000
	$1,168,500

This represents the total estimated costs for acquisition for the noted land rights.

ANNALIST'S CERTIFICATION:

I hereby certify that: I have no present interest or contemplated future interest in the real estate that is the subject of this review. I have no personal interest nor bias with respect to the property owners, the appraisers or the parties for whom this analysis was conducted. To the best of my knowledge, and belief, the statements of fact contained herein upon which the analysis, opinions, and conclusions expressed therein were based, are true and correct; my employment and compensation for making this review are in no way contingent upon the opinion reported.

ANALYSIS PERFORMED By: _____

R. A. Dickie
Certified General Real Estate Appraiser # 30832

FLOOD CONTROL DISTRICT
Of
MARICOPA COUNTY

INTEROFFICE MEMORANDUM

DATE: August 19, 1997

SUBJECT: STP Papago Regional Watershed Study. Review of Preliminary 30% Plans. FCD 95-46

TO: Scott Clement

FROM: Raj Shah

I have reviewed the preliminary plans for the above referenced subject. I have also sent plans and design reports to Richard Harris for Hydraulics Review, Afshin Ahouraiyan for Hydrology review and Fred Fuller for constuctibility review. Each reviewer will submit their own review comments separate. My review comments are listed below:

General Comments:

1. The removal of existing pipe will be expensive due to large pipe sizes. There are so many utilities involved and the trench excavation will be almost vertical. Also, with the new regulation of backfilling the trench up to top of pipe with 1 sack slurry backfill, the contractor will not know how hard that slurry backfill is around the existing pipe, so the contractor will bid higher for removing existing pipes.
2. The cost of the pipe installation will increase as the depth of trench increase because the contractor would have to bring special box plates to satisfy OSHA requirements for depths of 20' and more.
3. The junction structures from pipe to box to pipe will increase the design and construction cost since it will require special design and construction techniques.
4. The manhole construction for the 20' or deeper pipe may have to be special design.
5. The manhole construction for the dual box culvert will increase the project cost. The equivalent single pipe size would require only one manhole and cheaper to construct.
6. The double box culvert will require openings every so many feet to equalize the flow. This will require a special design.
7. The month dry-out period may increase the cost of pipe installation.
8. At pedestrian bridge, low clearance and sideslope at IBW outlet will increase cost of removing 84" pipe through that vicinity. The contractor may take a risk of jeopardizing the bridge pier.
9. The channel grading will be necessary from pipe outlet at IBW and Osborn Road to elevation below 1210' to daylight the storm drain.

Osborn Road Storm Drain Outfall:

1. Consideration shall be given to utilizing existing 84" and 72" pipes that are already in ground from Civic Center Blvd. to Indian Bend Wash. The following are some of the obvious cost savings related to using existing pipes:

    a. Do not have to demolish and construct existing outlet structure.
    b. Do not have to install new 102" RCP.
    c. Do not have to purchase additional TCE or r/w.
    d. Do not have to disrupt traffic on Osborn Road, Miller Road, 75th Street, and Civic Center Blvd.
    e. Do not have to relocate any utilities, Especially fiberoptic cables for hospital.
    f. Do not have to disrupt traffic to Scottsdale Memorial Hospital and Baseball Stadium.
    g. Do not have to jeopardize pedestrian bridge structure at the outlet structure.
    h. Do not have to abandon existing 8'X5' RCB, 84" pipe and 72" pipe.
    i. Do not have to demolish existing pavement.
    j. Do not have to disconnect and re-connect the existing lateral storm drain connections.
    k. Do not have to re-grade channel at Indian Bend Wash (IBW) outlet. (from Pipe outlet to daylight elevation of 1214)

2. The alternate basin site shall be evaluated if the Pauite basin does not have adequate capacity to store enough flow to reduce the peak in order to utilize the existing 72" and 84" pipe east of Civic Center Blvd. The alternate should evaluate the cost of purchasing additional basin site versus cost of removing and replacing the existing 72", 84" pipes and 7'X5' box culvert and other costs associated with it.

3. Since the cost of an additional basin and removing and replacing existing pipe is extremely high, City of Scottsdale should accept the lesser frequency storm drain due to the downstream pipe constraint. The consultant shall analyze the design frequency (i.e. 2-yr, 10-yr etc.) related to utilizing existing 72" and 84" pipes east of Civic Center Blvd. City of Scottsdale shall consume the increment cost of upgrading existing 72" and 84" pipes to 102" pipe and any other costs related to upgrading pipes or accept a lower frequency storm drain.

4. Show any additional rights-of-way or TCE may need to be purchased to construct the storm drain.

5. The conflicting utilities shall be avoided by adjusting the pipe profile. The consultant has reduced the pipe sizes to avoid the utilities. This may not be hydraulically good approach. Try to adjust the upstream and downstream storm drain profile to avoid the utilities.

6. From Sta. 52+00 to Sta. 84+00, keep the pipe north of the existing pipe to avoid removal cost of existing pipes.

7. From Sta. 72+50 to Sta. 92+00, change the pipe profile to avoid the 8" SS. If you adopt the comment #6, we may not have to worry about crossing this 8" SS at Sta. 81+.

8. Provide length of curve, radius and degree of curve at each of the curve.

9. At Sta. 112+, the box culvert is very close to the foundation of the transmission tower. Please check.

10. Evaluate lowering the Pauite Park basin by another 6" to 12" to provide additional storage and also to provide lower pipe outlet elevation of the pipe at Sta. 106+45. By lowering this elevation and adjusting the pipe slope upstream we may be able to avoid the 8" SS at Sta. 127+. Or recommended solution would be to adjust the profile without changing pipe diameter to avoid the 8" SS line. The other solution is to cut and plug the sewer line at Sta. 127+ and connect the north portion with the SS line shown north of the storm drain at Sta. 133+. Please check.

11. What is the purpose of the 3' staggered retaining wall around north and south side of detention basin? Why not callout 3' straight retaining wall?

12. Since we have 5' or more of cover, from Sta. 115+ to Sta. 122, why not use pipe instead of box culvert? The pipe is hydraulically more efficient, cheaper and easier to install than a box culvert.

13. Provide a low flow channels or pipes (swales) inside both of the detention basin so that for smaller events, the flow will not inundate ball fields.

14. Is the SS manhole shown on Pauite Park DB watertight?

15. Identify the rights-of-way needed at the Marriott Garden homes DB to modify the grading.

Oak Street Storm Drain Outfall:

1. The storm drain box culvert is extremely close to the 18" IRR line, and 18" waterline. One or the other may need to be relocated.

2. The box culvert size downstream of Sta. 28+, at few locations does not meet District's HGL criteria.

3. To avoid 18" IRR, at Sta. 24+, we may have to remove 18" W and upgrade 8" W to 24" W and shift the storm drain north, away from 18" IRR. Please check.

4. From Sta. 43+, the storm drain is extremely close to the 20" W. The solution would be to either protect in place 2" G or relocate 2" G and shift the storm drain south to keep it away from 20" W. Please check.

5. From Sta. 43+, use single pipe than a double box culvert because it will be easy to install pipe than double box culvert and also, it is cheaper to build one manhole than a double manhole. The double box culvert would require a flow equalizing openings every so many feet to keep the flow equal on each box. This will increase construction cost. The pipe is more efficient and cheaper to construct. Also, the junction box at Sta. 81+00 would be cheaper and easier to built for the pipe. Also, if for any reason jacking/boring were the preferred construction method to be chosen to pass under the cross cut canal, then pipe would be much cheaper.

6. From Sta. 53+, the storm drain is extremely close to 20" W and 24" IRR. Lines. The solution would be to relocate 2" G line and keep the storm drain on south half of the Oak Street.

7. At Sta. 81+00, why is the storm drain 25' deep? The lateral coming from south of 66th Street can also be raised at least 5' to 6'. Please consider changing the profile upstream and downstream of Sta. 81+00 to bring the storm drain close to 20' depth.

8. Please bring the 66th Street lateral at some radius instead of 90 degree.

9. Change the pipe and box sizes to next bigger size that is widely available and does not require special design.

10. Evaluate reducing the slope of pipe from Sta. 82+00 to 94+00. This will bring the storm drain few feet higher and reduce some excavation cost and at same time use pipe capacity more efficiently. The pipe is shown partially full.

11. Also, reduce the slope of the lateral coming in at Sta. 94+00.

12. At Sta. 121+, the storm drain is encroaching into the Arizona Army National Guard's rights-of-way. Also, the storm drain crosses two waterlines around this location. Evaluate re-directing storm drain at Sta. 120+00 toward north half of the street. This will avoid purchasing additional rights-of-way and avoid the utility conflict.

13. At Sta. 130+00, identify additional rights-of-way needed to construct the inlet structure and storm drain.

14. At Hubble Street, identify additional rights-of-way needed to construct the inlet structure and storm drain.

15. Evaluate reducing the slope of the 66th street lateral. This will reduce the excavation cost and also, utilize the full capacity of the pipe. The junction of Oak Street main line with 66th street lateral is shown 25' deep. Please check.

16. At the Automall basin, identify rights-of-way needed to modify the basin grading.

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009-6399
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5859

BOARD OF DIRECTORS
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Kimley-Horn & Associates, Inc.
7600 North 15th Street, Suite 250
Phoenix, AZ 85020

SUBJECT: STP Draft Recommended Plan Report, Plan Set, and Calculations

Dear Mr. Plasencia:

The District has completed our review of the subject material and has the following general comments:

I. Recommended Plan Report

1. On page 2-7, the statement is made that the existing storm drain in Osborn Road has most of the capacity necessary to convey the 10year runoff. This statement needs to be quantified. If it is not possible to quantify the capacity a range for capacity should be provided with the corresponding event frequency.

2. On page 3-8, Table 3-3 you have provided a line item for utility relocations. Please provide backup documentation indicating the cost utilized for each type of utility relocation and its units.

II Draft Plan Set

1. In general each sheet should have the notes set up with two main headings: REMOVE and CONSTRUCT. Under each of these headings the major items of removal and construction should be listed and this should include utility relocations that will be performed by the contractor (water service, sewer service, SRP irrigation, etc). For this level of effort in the plan set we do not expect that these items for removal and construction be tied down to station numbers and quantities.

2. Many of the notes do not have a corresponding number on the plan view and the numbers on plan sheets have no corresponding note.

3. The proximity of the proposed storm drain to numerous existing parallel utilities is of a concern to the District. Including the wall thickness, manholes

bases and variance of actual locations, the proposed storm drain could be in conflict at numerous locations. Please review and provide recommendation.

4. There are numerous instances where the proposed new storm drain line is within 3 to 5 feet of an existing waterline. Depending on the type of waterline pipe material, for example ACP, this could pose a safety hazard to the contractor and could require a shutdown of the waterline and by-pass. In these instances the type of waterline pipe material needs to be determined and if it is found to be ACP a shutdown and by-pass might be required.

5. The plans do not show the locations of any of the junction structures. Please indicate these in the plan and profile views.

6. The profile views should include the locations of all crossing utility lines. In those cases where the elevations of the utilities are not known, and the utilities cross the proposed storm drain, they should be noted as such.

Attached are detailed comments on the subject material from other reviewers as noted at the District. If you have any questions please call me.

Sincerely,

H. Scott Clement, P.E.

Kimley-Horn
and Associates, Inc.

August 12, 1997

Suite 250
7600 N. 15th Street
Phoenix, Arizona
85020

RECEIVED
AUG 19 1997
KIMLEY - HORN & ASSOC.
PHOENIX, AZ

Robert Mauer
Salt River Project- Water Engineering
PO Box 52025
Mail Station PAB106
Phoenix AZ 85072-2025

Dear Mr. Mauer:

Attached are draft preliminary plans for the STP-Papago Watershed Study as prepared for the Flood Control District of Maricopa County. At this time, we are requesting confirmation of utilities as demonstrated on our plan set. The information will be used in developing cost estimates, and in preparing the final design for subsequent phases of this project.

The recommended plan for this project includes the Oak Street and the Osborn Road outfalls to Indian Bend Wash. The Oak Street Outfall collects runoff from Papago Park, the Arizona National Guard facility and the Hy-View neighborhood and conveys it east along Oak Street to Indian Bend Wash. The Osborn Road Outfall begins at the Marriott Brighton Gardens basin on Thomas Road, continues along Catalina Drive and under the Cross-Cut Canal to Paiute Park, where the flow is detained. The Paiute Park basin will then discharge to a storm drain running east along Osborn Road to Indian Bend Wash.

In order to minimize future utility conflicts, we are asking you, the utility owner, to verify the location of your underground services. If you believe any locations to be inaccurate or missing, please mark up the plans with your best understanding of the horizontal location and vertical elevation of the utility.

We understand the time this may take, and appreciate your assistance. We have provided a self-addressed stamped envelope for your convenience and would appreciate receipt of your mark-ups no later than August 28th, as our final plans are due shortly after. If you have any questions, please contact Robert Jeter at (602) 944-5500.

Sincerely,

KIMLEY-HORN & ASSOCIATES, INC.

Rob Jeter for DSP

Doug Plasencia
Project Manager

cc: H. Scott Clement, FCDMC

Reviewed - Comments noted; AS-BUILTS ENCLOSED - Please submit full size 60% for Review; later I will require finals for issuance of Construction License! Thx - Bob

TEL 602 944 5500
FAX 602 944 7423

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009-6399
(602) 506-1501
FAX: (602) 506-4601
TT: (602) 506-5897

August 20, 1997

MEMO TO: Scott Clement, Raj Shah

FROM: Afshin Ahouraiyan

SUBJECT: STP Draft Recommended Plan

The subject hydrology report has been reviewed. The following comments need to be addressed by the consultant.

General

The flows used in the StormPlus program do not match the flows from the HEC-1 models. The flows should be the same between the two programs.

The routing cards in the proposed conditions should reflect the proposed structures. An example is that the HEC-1 model utilizes trapezoidal shapes for the routings of flow in Oak Street, whereas the proposed structure is a pipe system and therefore should have circular configuration in the routing card. This is the same case for the system in 66th Street.

Technical

The flow splits used in the HEC-1 model after the detention basins for the Osborn Road improvements need to be explained. An analysis is required as to how these values are calculated.

It is recommended that the three hydrographs flows at 66th street are added first and then the 10-year flows diverted in the pipes.

Explain in the model that the culverts out of the Auto Mall Detention basin, under McDowell Road will be plugged up at both ends during the construction phase of theis project.

I also request that a meeting be set up with the consultants' hydrologist as the logic behind the hydrology modeling for the area after the Paiute Park Detention Basin for the Osborn Road proposed improvements is difficult to follow.

Please call me at ext. 4519 if you have any questions on this matter.

FLOOD CONTROL DISTRICT
of
Maricopa County

Interoffice Memorandum

DATE: August 20, 1997

TO: RCS

FROM: RPH

SUBJECT: **STP Papago Regional Flood Control Project Watershed Study, Draft Recommended Plan**

I have reviewed the subject materials, and offer the following comments:

Hydraulics

1). Based on the plans, the outlet elevation of the Oak outfall at the IBW (1206.5') is lower than the adjacent existing ground (1209.8', est.). To ensure positive drainage, a channel will need to be constructed from the outlet to a point within the IBW which is lower in elevation than the outlet. Please address.

2). Based on the plans, the outlet elevation of the Osborn outfall at the IBW (1214.6') is lower than the adjacent existing ground (1222.0', est.). To ensure positive drainage, a channel will need to be constructed from the outlet to a point within the IBW which is lower in elevation than the outlet. Please address. The current plan does not show any elevation contours within the IBW which are low enough.

3).When the beginning tailwater for the Oak outfall is made 2' higher than the soffit elevation, per FCD analysis of the IBW during concurrent flooding, the calculated HGL at the Miller Road manhole is above the ground, and this condition extends over 1000' up-drain. However, this condition is not carried into the region of the Auto-Mall basin since the calculated HGL elevation at that point is 1267.21', below the basin rim. Consider increasing the pipe size of the 66th street lateral in order to save money (over the box culvert listed in the StormPlus model), and meet both the FEMA and storm drain project design criteria.

File Folder: IO-MEM79

Further cost savings could be realized if the transition at station 82+29 (StormPlus ID) were moved downstream to a point below the junction, and the manhole at station 81+00 moved upstream to the junction of the main pipe and the 66th St. lateral. By doing this the type of junction needed could be changed from "special design junction box" to a regular junction box, saving nearly $30,000.00.

4). The invert elevation of the connector pipe at station 15+01.52 on sheet 3 is 1' lower than the respective invert in the StormPlus model. Please rectify.

5). Between the Oak Street Main Line Stormplus model, stations 67+77.26 and 74+18.13, there is only 1 manhole per the plans, not 3 as shown in the model. Please correct.

6). For the StormPlus model oak6100.dat, the section number for station 95+02.68 should be 5 per the plans, not 4. Also, the number of manholes should be 2. Please correct.

7). Per the plans for the Oak Main Line, the first 1800' long segment of the box culvert should be modeled using section 2, not section 1. Please correct.

8). Although the goal for the proposed design is to provide subcritical flow conditions throughout both systems, the output of the Oak Main Line shows supercritical flow at several locations and hydraulic jumps occurring at two locations. Please address potential flow instability in the design.

9). Per the plans for the 66th Street lateral, the first 2150' segment of the system is a 54" pipe, not a box culvert as modeled. Please rectify both plans and model. Also, the number of manholes at stations in the model should be corrected as follows: 1 manhole at station 20+31.69; 2 manholes at station 21+90.27; 1 manhole at station 26+70.00.

10). Per the plans for the Osborn outfall, the model should be revised to include a JX record for the 42" pipe proposed near station 12+60, sheet 21.

11). It is unclear why there is an extremely short modeled reach within osb6100.dat which uses a 5' x 16.75' box culvert (without a pier) between stations 21+30.29 and 21+31.00. Please explain.

12). Per the plans, the size of pipes shown near station 24+89.78, sheet 22 of the Osborn Drain, are 54" and 42". These do not match the 2' diameter pipe modeled for that location. Why weren't the larger pipes modeled?

13). The Osborn model has a JX record at station 31+47.51 for a

4′ diameter pipe, while the plans (sheet 23) show an 18" pipe there. Please rectify.

14). On plan sheet 23 there is a proposed 42" RCP shown joining the Osborn outfall near station 36+15.00, yet the StormPlus model does not have a JX record to reflect it. Please rectify.

15). The Osborn model has a JX record at station 38+35.00 for a 4′ diameter pipe, while the plans (sheet 24) show a 5′ pipe near there. Please rectify.

16). The Osborn model should be revised to include the 2 manholes shown on the plans between stations 47+10.00 and 38+60.00 (sheets 24 & 25). Also, there are no manholes between stations 48+99.45 and 47+10.00.

17). The beginning tailwater used for the storm drain upstream of the Paiute Park Basin (model OSBS6100.DAT) should equal the headwater at the inlet of the pipe which empties the basin (model OSB6100.DAT), elevation 1256.4′.

18). Per the plans for station 81+71.33, sheet 28, the Osborn model should be revised to account for a transition section there.

19). The plans show a 36" RCP between stations 81+71.33 and 82+02 on sheet 28, while the StormPlus model shows a 3.5′ x 8.5′ box. Please clarify so that the plans and the model agree.

20). Per the plans for station 90+20.00, the Osborn model should be revised to reflect the invert elevation shown on the plans, or vice versa. Please clarify so that the plans and the model agree.

21). The plans show a 42" RCP between stations 90+20 and 90+50 on sheet 29, while the StormPlus model shows a 3.5′ x 5′ box. Please clarify so that the plans and the model agree. Also, the plans show a 36" RCP between stations 90+20 and 90+50 on sheet 29, while the StormPlus model shows a 3.5′ x 5′ box.

22). There is a JX record in the StormPlus model at location 123+19.46, although there is nothing shown on plan sheet 32 to reflect any proposed or existing structures. Please rectify.

23). Per sheet 32 of the plans, there should be a manhole added to model osbs6100.dat between stations 123+69.46 and 127+30.00. Also, the two manholes shown in the model at station 127+72.58 should be removed from the model.

24). The 48" RCP shown on the plans extending upstream from station 123+96.46, sheet 32, is modeled as a box. Please clarify so that the plans and the model agree.

25). The plans show a 8′ x 3.5′ box culvert between stations 127+72.98 and 127+85.00, sheet 33, while the StormPlus model shows a 3′ x 4.5′ box. Please clarify so that the plans and the model agree.

26). The total width of section number 2 as listed in the Osborn model is 2′ wider than that shown on the plans. Please rectify.

Report

1). Figure 2-2 should be revised to reflect the alignment of the Osborn Drain down Catalina Drive.

2). Figure 2-2 should be revised to reflect that no section of drain above the Paiute park basin is currently proposed as "Open Channel".

3). To improve clarity in the report text, the last paragraph on page 3-6 and the one above it should be switched.

4). The unit cost of rebuilding sidewalk (shown on Table 3-3) is closer to $12.00 per linear foot (estimated @ $4.00/sf).

Plans

General

1). A note should be included in the plans stating that, "all utilities will be protected in place, unless otherwise noted on the plans".

2). It is not clear from the plans where the location of most of the junction boxes are, since their locations (found by StormPlus) on the plans show either a "manhole", a "transition", or simply a small pipe connected to the main pipe. Where junction boxes and special junction boxes are indicated by the StormPlus model, they should be labeled and the joining drain should be shown on the plans, with the proposed invert elevation, size, and direction of approach towards the main pipe labeled.

3). The 8'-10' lengths of the outlet structures shown for both outfalls at the IBW do not suggest adequate length for energy dissipators. It would be useful if these structure sizes were estimated and drawn more representatively in order to better estimate needed ROW and identify potential conflicts.

4) Show existing lateral pipe inverts for all those pipes which will be joined to a proposed trunkline. Also, all laterals identified in the models must be shown on the plans.

Oak Outfall

1). While the cost estimate shows a total of 13 manholes and 19 junction boxes for the Oak outfall, I counted 35 manholes and 9 junction boxes per the StormPlus model (not counting what appear to be "double" manholes where the drain is a double box). The unit cost for a junction box is seven times greater than a manhole. The cost estimate should be revised.

2). Wherever overhead power or telephone lines cross the proposed alignment, a caution note is needed on the plan.

3). The plans should show the size, depth, and type (e.g., DIP vs. ACP) of all potentially conflicting utilities in order to better determine which will need replacing rather than protecting in place.

4). The slope calculated from the elevations shown on the plans between stations 30+53.65 and 29+80.65 is closer to 0.0008 ft/ft. Please relabel the plans or change the StormPlus data.

5). Any proposed connector pipes such as that shown near station 36+30 should be at least 15" in diameter. Please rectify.

6). Since the Oak outfall between 66th Street and Scottsdale Road is quite deep, a pipe alternative to the proposed box should be considered to save money.

7). The 20" water main which runs within 2' of the proposed Oak outfall from station 43+00 to station 55+50, and then across the alignment from 55+50 to 57+00, must be identified as to the type of material which it is made of in order to be determine if special considerations must be made during construction.

8). A note is needed on the Oak outfall plans stating to relocate or protect in place the 2" gas line shown running within 2' of the south edge of the drain between stations 41+80 and 55+20.

9). Show existing benchmarks located throughout the study area. It would be useful to have those which fall within the plans shown and described.

10). Pipes sized 33" and 57" are atypical are not commercially available. The next larger sizes should be used.

11). Under the current design, the 66th Street Lateral StormPlus model, 66th6100.dat, uses a box culvert to model flows from station 10+00 to station 21+57.25, while the plans show a 54" pipe for that reach. By running the model with the 54" pipe it is evident that the plans must be mislabeled. Please correct.

12). By comparing contour lines shown on the plan near the inlet of the 64th Street lateral with the inlet elevation of the pipe, it looks like there will be over 8' drop into the pipe entrance. Special inlet considerations, such as a grouted rip-rap apron or other stabilization will be needed to prevent head cutting. A similar condition seems to exist at the inlet of the Osborn main pipe, station 130+95 (6' drop). Please address both.

Osborn Outfall

1). While the cost estimate shows a total of 7 manholes and 21 junction boxes, I counted 30 manholes and 13 junction boxes per the StormPlus model (not counting what may be "double" manholes where the drain is a double box). The unit cost for a junction box is seven times greater than a manhole. Please revise the cost estimate or rectify otherwise.

2). The temporary construction and permanent drainage easements needed immediately above the outlet of the Osborn Drain should be shown on the plans.

3). Transition sections for the Osborn outfall shown in plan view between stations 17+78 to 18+27 and 24+13 to 24+33 do not reflect the stations in profile and what was used in the StormPlus model. Please rectify.

4). Note number 5 on sheet 22 says "connect existing lateral to storm drain", and note number 16 which is immediately upstream says, "plug existing storm drain". Please explain.

5). The 2' diameter lateral modeled in the StormPlus model at station 22+25.00 should be labeled on the profile, sheet 22.

6). The proposed 42" and 54" RCP's shown on sheet 22 are existing in plan view. Are they labeled proposed to reflect alignments changes? Also, it would be helpful if you listed all proposed pipes as a certain length of new pipe on the plans in order to further substantiate the cost estimates.

7). For the existing and proposed storm drain alignments shown at 75th street and Osborn Road, a special structure may be needed at their junction. If not, then the manhole located at station 30+00 should be moved at station 31+47.

8). The proposed 60" RCP shown at station 38+50 should be moved so that it does not join the main pipe within a transition section (the location of this feature per StormPlus is actually station 38+35).

9). If it can be assumed that the connector pipes shown on the plans at stations 43+38, 44+84, and 46+50 will be joined to the

trunk line at 90 degree angles, then these connections need to be accurately shown on the profile at the same locations. Please correct or otherwise substantiate.

10). The proposed 48" RCP shown at station 46+93 is not modeled in the StormPlus model. Please correct.

11). Due to the close proximity of the 8" sewer to the proposed manhole at station 50+85.47, a better location for the manhole would be at the junction of the trunk line with the proposed 66" RCP at station 51+15.

12). The StormPlus model shows a 42" pipe where the 66" lateral pipe is shown on the plans at station 51+15 (sheet 25). Please rectify.

13). Note number 8, which points to the trunk line at station 51+36, is not listed in the notes section on the plans. Please add.

14). A note is needed for the existing 72" storm drain regarding plugging it where it will be abandoned, and removing it where it conflicts with the proposed system on sheet 25. Also, due to anticipated construction problems with the new system and in order to save money and reduce right-of-way problems, the existing system from Civic Center Blvd. east to the IBW should be considered as a preferred design alternative.

15). There is an unidentified small box structure located at station 52+08 where the proposed storm drain alignment is shown. The box is connected to a telephone line issuing from a telephone box. Please identify both structure and intent.

16). The location on the plans where the note "Exist 24" RCP to be removed (typ)" does not make sense. First, that location does not need removal, and second, the idea of a typical removal is not adequate. Also, note number 4, located at station 56+24, is not listed in the notes section on sheet 25. Please add.
removals should be shown as to extent (and it would be helpful if noted by length) throughout the project. Please correct.

17). Per the osbs6100.dat model, there will be a 5' pipe near station 57+82.00. Please show on the plans.

18). The size of utilities and a note regarding intent for them is needed at the following locations: telephone, station 57+83; gas, station 60+08; gas, station 63+08; sanitary sewer, station 64+40. Please add.

19). The StormPlus model shows a 54" lateral pipe at station 64+30.69, which when located on the plans is at the joint between a transition section and an 84" RCP. One or the other should be

moved.

20). The existing 8" sewer shown in profile at station 72+32 will need to be encased due its apparent close proximity to the storm drain.

21). The note to plug the existing storm drain at station 77+16 does not make sense since the existing drain at the location will be removed.

22). The StormPlus model shows a 72" lateral pipe at station 77+43.12, which when located on the plans is at the joint between a transition section and a 78" RCP. One or the other should be moved.

23). The StormPlus model shows a 42" lateral pipe at station 87+49.69, which when located on the plans is at the joint between a transition section and a 66" RCP. One or the other should be moved.

24). The estimated volume of excavation required for the Paiute Park basin should be substantiated with cross-sections and calculations in the report. My estimated volume was nearly 30% less, which would yield a savings of around $50,000.00.

25). The depth of the 10" sanitary sewer shown running along the bottom of the Paiute Park Basin should be investigated to determine if the sewer needs encasement, replacement, or nothing.

26). A note for the telephone crossing of Osborn near station 90+50 needs to be added to the plan.

27). When the correct beginning tailwater is used for the segment of the Osborn Road outfall which empties into the Paiute park basin (see related comment under "Hydraulics"), the upstream HGL elevation is raised so that the design criteria (of 1' below ground for the HGL) is not met around the proposed manhole at station 111+00 (where the HGL is shown to be at ground level). Also, this manhole is not shown to extend upward to match proposed grade. Please rectify. At the system head works, the HGL elevation was calculated to be 1271.19', which appears to be less than 1' from the top of the basin---this may be less than acceptable depending on design standards.

28). The 8" sanitary sewer shown near the Paiute Park basin on sheet 31 enlarges to 10" on sheet 30, without any connecting lines shown. Please check.

29). The plans show a telephone line crossing the main storm drain near station 127+60. A note should be added describing intent for the line.

30). The StormPlus model has a JX record for a 48" lateral pipe at station 127+75. When located on the plans this pipe would not fit within the proposed trunk line segment. Please clarify.

31). Per the StormPlus model, there is a 24" lateral pipe (JX record) at station 140+10, although there is nothing shown in plan or profile on sheet 34. Please correct the plan or rectify otherwise.

32). Per the StormPlus model, there is a 24" lateral pipe (JX record) at station 145+40, although there is nothing shown in plan or profile on sheet 34. Please correct the plan or rectify otherwise.

33). Per the StormPlus model, the 42" pipe shown on sheet 34 extends to station 148+00 on sheet 35. Please correct the plan or rectify otherwise.

34). Due to the proposed 6′ depth and 4:1 side slopes of the Marriott Brighton Gardens and the Residential Character or the surrounding neighborhood, I recommend perimeter fencing. Fencing is usually not recommended where side slopes are 6:1 or flatter, for the given depth.

35). All basin bottoms should have sufficient labeling to indicate a positive grade towards the outlet of at least 0.005 ft/ft.

36). For the present configuration of the Paiute Park Basin, a low-flow drain should be added between the pre-basin and the main basin outlet to ensure that the 3′ deep pre-basin will drain within 36 hours. This is recommended since past maintenance experiences in other areas suggest that fine sediments will accumulate and reduce basin infiltration capacities to the point that the basin will not infiltrate, posing a health hazard.

37). For sediment removal, the pre-basin may be better situated within the Marriott Brighton Gardens basin.

38). The plans should show the proposed location of the entire length of the maintenance access road for the Marriott Brighton Gardens basin, connecting to an existing street.

091131.00 (recc plan)

CITY OF
SCOTTSDALE
ARIZONA

• "Most Livable City" U.S. Conference of Mayors •

August 26, 1997

Scott Clement, P.E.
Project Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Subject: Draft Recommended Plan

Dear Scott:

As a follow-up to our meeting on August 21, I would like to take this opportunity to formalize the Transportation Department's comments on the referenced document.

Page 2-4
With regard to a potential Letter of Map Revision for the Hy-View neighborhood, we prefer to focus on providing a complete, structurally-based solution to the floodplain issue as quickly as economics will allow. For this reason, we would like to see the Conditional Letter of Map Revision process for the recommended solution begin before moving into final design. Any input we can gain from FEMA at the concept design phase should assist us during final design.

Page 2-5
We concur with the recommendation to continue pursuing the Smitty's parking lot route as an alternative to the Thomas Road alignment for the upper reach of the Osborn Road Outfall.

Page 2-7
We support using the existing storm drain in Osborn Road between Civic Center Boulevard and Indian Bend Wash to gain as close to 10-year protection as is possible. Our one concern is that future conditions not be worsened west of Civic Center Boulevard along Osborn Road.

Page 3-7
Another issue in the maintenance of traffic flows during construction will involve access to Tonalea Elementary School and Coronado High School. Both of these schools are located along the Oak Street Outfall alignment.

Page 4-1
The recommended Phase I for the Osborn Road Outfall proposes all improvements planned for Paiute Park be included in the 64th Street road-widening project between Thomas and Indian School Roads. This project is scheduled to begin July 1998. Additional coordination regarding final design issues and budget implications will need to occur in the near future, if this recommendation is to move forward.

We appreciate the District's continued participation in this important project and look forward to the completion of the Recommended Plan. Please call me if you have any questions.

Sincerely,

Dave

David Meinhart, AICP
Public Works Planner

copy to: Alex McLaren
Doug Plasencia, Kimley-Horn

Tel: 602-371-6965
Fax: 602-371-7251
e-mail: sgoodm01
@apsc.com
http://www.apsc.com

Mail Station 3539
P.O. Box 53933
Phoenix, AZ 85072-3933

August 27, 1997

RECEIVED
AUG 29 1997
KIMLEY - HORN & ASSOC.
PHOENIX, AZ

Mr. Doug Plasencia
Project Manager
7600 N. 15th St., Su. 250
Phoenix, AZ 85020

Re: STP-Papago Watershed Study

Dear Mr. Plasencia:

Thank you for the preliminary plans for this project. I have reviewed them and they appear to be correct as shown. It does not appear that any APS facilities will be required to be relocated. I have returned your plans as requested. Please keep me informed as to the status.

I can be reached at 371-6965. Thank you.

Sincerely,

Steve Goodman
Project Design Leader
System Improvement

cc: Enclosure

WATER AND WASTEWATER OPERATIONS REVIEW

Project No.	95-96
Project Name	Papago regional flood control project
Reviewer	Tritz
Date	8-28-97
Submittal	conceptual/30%

No.	Dwg.	Comment	Action by A/E*
all		Per C.O.S Design Standards and Policies Mauual	N
all	#1	All galvanized and polyethylene sizes ¾" to 2" which are exposed during construction shall be replaced in their entirety pp11	
all	#2	When crossing any watermain the main must be replaced with ductile iron pipe extending min 5' into undisturbed soil	
all	#3	Vertical realignments shall be per C.O.S. det# 2370. For areas where there is less than required separation and there is not any direct conflict contact Larry Tritz Water Operations Liason at 391-5631 for separtation waiver. When necessary to realign vertically aviod extreme depth if possible.	
all	#5	Referr to item #2 above for sewer crossings. We preferr D.I.P. replacements over encasement.	
all	#6	When sewer services are in conflict, realignment will start at the connection to the main.	
all	#7	If a manhole is to be located in a retention area it would have to be monolithic with a bolt down ring and cover (sht#36). The cover on the sewer in this area would need to be adressed also.	
		The west boundries of this project are on the borders of the Scottsdale and Phoenix service areas. Contact them for complete info on their utilities. When final design occurs definition of these lines should be made to avoid confusion.	
Sht#3 &4	none	Separation between the storm sewer and the 18" watermain would be inadequate my records describe it as RCP circa 1973 for info only	n
sht #6,7&9	none	Separation between 20" inadequate. To cross under these waterlines in the manner suggested would be extremely dangerous	n
sht#32	13	The 6" line would have to be relocated. It could not be protected in place	n

WATER AND WASTEWATER OPERATIONS REVIEW

sht#35	none	City of Phoenix water lines are not shown on these plans. For info purposes only my records show the following lines in Thomas Rd one 48" circa 1948,two 36's circa 1928 and 1930, and one 24" 1973. These are major transmission mains, Our 12" or 8" whichever is circa 1958	n
		Gennerally all you show is relatively accurate except as noted above and as note earlier. This is a border area and there was a separation project that took place about eight to ten years ago. I cant remember the job name but they should be in records. These plans should be consulted for design on this project. Hopefully all the info supplied has been of some help. If you would like to look at some of our records feel free to call. This is obviously a major undertaking and will have an impact in our operations. Please let me know if I can be of further assistance. Thanks. Larry Tritz City of Scottsdale Water Operations	

*C - Compliance N - Non-compliance, Explanation by A/E required

SOUTHWEST GAS CORPORATION

September 5, 1997

Mr. Doug Plasencia
Kimley - Horn & Associates
7600 North 15th Street, Ste. 250
Phoenix, AZ 85020

Dear Mr. Plasencia:

SUBJECT: STP - PAPAGO WATERSHED STUDY
FCD OF MARICOPA COUNTY
PROJECT NO. 95-46

Your design for the above referenced project indicates there will be trench excavations paralleling and crossing our gas lines. Actual conflict can be avoided if your proposed facilities are installed to provide a minimum 12 inches face-to-face clearance at the point of crossing. **Please be aware that Southwest Gas does not provide depth information for its gas lines. In order to avoid future construction delays, we encourage you to carefully evaluate each gas line crossing, including the use of potholing if necessary**, to discover potential conflicts well in advance of your scheduled construction.

Prior to any excavations, please have your construction contractor call Blue Stake at 263-1100 so the existing gas pipes may be accurately located. Your contractor should hand dig carefully at these marked locations until the gas pipe has been found and exposed. Use care to avoid damaging or breaking a small electrical tracer wire (which is used for locating purposes) that may be buried with the pipe.

Once mechanical trenching is in progress, do not attempt to trench within two (2) feet of a gas pipe. This trenching shall be done by hand in order to prevent any damage to the gas pipe. In the event your contractor should "hook" or otherwise strain a gas pipe while excavating, a call should be placed to 271-GASS (271-4277).

Even though there may not be any apparent damage, the strain may have damaged the wrap or a portion of the buried pipe or fittings at other locations causing a leak in the surrounding area. Also, if a steel facility is exposed and the pipe coating is found to be in need of repair, please have our office contacted so a crew can be dispatched to rewrap the pipe. This is a service provided by Southwest Gas at no cost to the contractor so that we can monitor our steel facilities and minimize the possibility of corrosion.

When the excavations are complete, all exposed gas pipes should be protected. If the trench is more than three (3) feet wide, the pipe must be supported in a manner where the supporting material does not damage the pipe or its protective wrapping. Please have your construction contractor call Southwest Gas at 484-5306 to review and approve all proposed pipe support designs.

Administrative Offices: 10851 N. Black Canyon Highway
P.O. Box 52075 / Phoenix, Arizona 85072-2075 / 602-861-1555

Before backfilling, the natural gas facilities require both six (6) inches of bedding and six (6) inches of shading with sand or material free of rocks and able to pass through a 3/8 inch screen in order to provide firm support under the facility and to prevent damage to the pipe or pipe coating from the backfilling operation. When backfilling, do not drop backfill directly on the exposed gas pipe. When compacting backfill, use extra care when directly over the gas pipe in order to avoid any damage.

Thank you for your cooperation on this project. Please feel free to contact either Bob Sprague at 484-5343 or myself if you have any questions or require additional information.

Sincerely,

Dominique Mitchell
Distribution Engineer
Mail Station 42O-586
(602) 484-5306

lmp

c Sales
Bob Sprague RS
File 9708519056

STS, INC.
ENGINEERING TRANSMITTAL

SUPPLEMENT NO. _____ WORK ORDER NO. 410-97-4989

TYPE OF WORK CONFLICT REVIEW RECEIVED FIELD JOB NO. 721A171

DESIGNER ASSIGNED THOR SKOSPN SEP 28 1997 SCALE _____

DRAFTER ASSIGNED _____ KIMLEY - HORN & ASSOC. PHOENIX, AZ FOOTAGE _____

DATE ASSIGNED 08-26 DATE DUE 09-10

DESIGN UNITS _____ DRAFT UNITS _____

CHECK UNITS _____ FIELD UNITS _____

LOCATION SLE - S.T.P. PPPGO REGIONAL FLOOD CONTROL

DESCRIPTION OF WORK: LOO # 24284.516

PROJ# 95-46

CONTACT JOHN AKER

PHONE NUMBER 831-4702

TOTAL PAYOUT _____

DESIGNER/DRAFTER AGREES TO ACCEPT AND PERFORM THIS WORK AT THE COST INDICATED ABOVE AND TO PROVIDE ANY AND ALL CORRECTIONS ASSOCIATED WITH THIS JOB. 10% OF THE TOTAL PAYOUT WILL BE WITHHELD UP TO 4 WEEKS, PENDING CHECKING OF THE JOB BY CUSTOMER AND COMPLETION OF ANY CORRECTIONS AND/OR STAKING AS REQUIRED.

ENGINEERING MANAGER _____ DATE 8-26 DESIGNER/DRAFTER _____ DATE 9-17-97

FOR OFFICE USE ONLY

NOT TO EXCEED _____ INVOICE _____

DESIGN HRS _____ DRAFTING HRS _____ FIELD HOURS _____ DATE _____

WEEK ENDING	RATE NAME	HRS.	ACCM.	TOTAL BILLING AMT.	TOTAL BILLING ACCM.	WKLY TOTAL BILLING RATE	WIP AMT.	WIP ACCM.	WKLY TOTAL COST

ADM 08 REV. 9/95

1997 CONFLICT TRANSMITTAL NOTICE

Date: **8/26/97** Date Due **9/10/97** USWC log # 24284.516

Contractor log # 410-97-4989

Job Number 721a171 Sheet Number <5K

Cell team: WC: sc GEO: 153180 CLLI: scdlazma

Field Engineer: Ed Zadravec 831-4691

CP Planner: Cindy Brown (303) 707-8783

Project Name: S.T.P. Papago Regional Flood Control Project Watershed Study

Contract Engineer OAK ST. AND OSBORN RD.

Originator: Kimley-Horn & Associates, Inc.
7600 N. 15th Street, Suite 250
Phoenix, Arizona 85020
Attn: Doug Plasencia 944-5500

Following the Public Improvement Guidelines do the the following:

1. List the type(s) of facilities within the limits of this project (aerial, underground, buried)

2. If no conflicts send a reply to originator and go to #7. If there are conflicts <5K obtain sheet number, coordinate with field engineer, and issue the job. Estimate cost by FRC.

NO APPARENT CONFLICTS - BLUE STAKE REQUIRED
Recommend extreme caution at Road Crossings - numerous locations will cross existing cables.

3. How many potholes are recommended to secure elevation and location data?
What is the total cost authorized to be billed to USWC?

5. Right -of Way issues. Are the facilities within this project in USWC own right-of-way?
If so estimate the cost of relocation and inform the originator.

6. Are any cost recoverable?

7. Total cost of engineer labor.

8. Summary of action taken.

DATE 9-17-97

U S West Communications
6350 South Maple Ave. Suite -
Tempe, Arizona 85282

MEMORANDUM TO: JOHN AKER

ATTENTION: _____ PHONE _____

REGARDING PROJECT: 721A171

X YOUR PLANS HAVE BEEN RECEIVED BY U S WEST COMMUNICATIONS AND REVIEWED BY ONE OF OUR CONTRACT ENGINEERS. NO APPARENT CONFLICTS WERE FOUND.

_____ YOUR PLANS HAVE BEEN RECEIVED BY U S WEST COMMUNICATIONS THE FOLLOWING CONFLICTS WERE FOUND:

NO APPARENT CONFLICTS FOUND -
BLUE STAKE REQUIRED
Recommend extreme caution at road crossings - numerous locations will cross existing cables.

IF YOU HAVE INQUIRIES, PLEASE CONTACT:

NAME: THOR SKOGAN PHONE: (602)654-1363
PLAN REVIEWER

NAME: _____ PHONE: (602) _____
USWC FIELD ENGINEER

conflict reply 6/10/97

Transportation Department

7447 E. Indian School Road, Suite 205
Scottsdale, Arizona 85251
Phone: (602)994-7696 • FAX: (602)994-7971

FAX COVER SHEET

FAX #: 944-7423	**From:** Dave Meinhart, Public Works Planner
Name: Don Rissmeyer	**Date:** September 25, 1997
Company: Kimley-Horn	**Project:** STP-Papago

Total Number of Pages: 2 ☐ Originals Being Sent via: _____

REMARKS:

☐ Urgent ☒ For your information ☐ Please comment ☐ Reply ASAP

As we discussed. These costs include appurtenances, such as fittings, fire hydrants, valves, etc.

If you are experiencing any difficulties in receiving this facsimile, please call (602) 994-7696.

City of Scottsdale
Unit Prices
Water/Sewer Projects

Type	Unit	Quantity	Private Development Unit Costs 1996-97	City Projects Unit Costs 1995-97	Current CIP Unit Costs 1997/2002	Master Plan Updated Unit Costs, 1997	Recommended Unit Costs 1997/98
Waterlines							
12-inch ductile iron pipe	LF		$27.00	$60.00	$40.00	$42.00	$42.00
16-inch ductile iron pipe	LF		$70.00	$80.00	$80.00	$57.00	$80.00
20-inch ductile iron pipe	LF			$122.00		$78.00	$80.00
24-inch (DIP or PCCP)	LF				$120.00	$99.00	$100.00
36-inch (DIP or PCCP)	LF			$156.85	$200.00	$161.00	$200.00
Sewerlines							
8-inch sewer line (PVC)	LF		$31.00	$56.00	$58.00	$52.00	$58.00
12-inch sewer line (DIP)	LF		$42.50	$127.00		$62.40	$65.00
15-inch sewer line (PVC)	LF		$70.00			$80.00	[illegible]
18-inch sewer line (PVC)	LF		$60.00			$89.44	$90.00
21-inch sewer line (PVC)	LF				$145.00	$98.80	$100.00
24-inch sewer line	LF		$140.00			$114.40	$125.00
27-inch sewer line	LF			$135.00	$121.00	$124.80	$135.00
30-inch sewer line	LF					$135.20	$145.00
36-inch sewer line	LF			$165.00			$165.00
Reservoirs							
Any size	gallon			$1.00	$1.00	$1.00	$1.00
Booster Stations							
0.5	mg					$333,000.00	$333,000.00
1	mg					$416,000.00	$416,000.00
2	mg					$515,000.00	$515,000.00
3	mg					$624,000.00	$624,000.00
5	mg					$832,000.00	$832,000.00
10	mg					$13,331,000.00	$13,331,000.00

6"W 30—
8"W 35—
power pole 5000—
[illegible] 12—