

## WHPacific

6501 Americas Parkway NE, Suite 400  
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505.247.0294 • fax 505.242.4845

# Barranca Watershed Park Management Plan

AERIAL PHOTO DATE: 2009

Arroyo de Los Molinos

UNSER BLVD  
PROGRESS BLVD  
KING BLVD  
UNSER BLVD  
PASEO DEL VOLCAN  
30TH ST NE  
19TH AVE NE  
40TH ST NE  
IDALIA RD  
NORTHERN BLVD

WESTPHALIA BLVD

Venada Arroyo

WESTPHALIA BLVD

IRIS RD

CHAYOTE RD

IDALIA RD

PASEO DEL VOLCAN

ENCHANTED HILLS BLVD

528  
RIO RANCHO BLVD

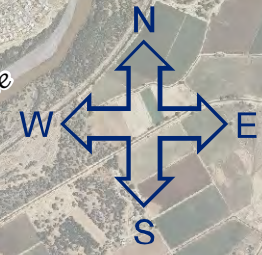
Barranca Arroyo

IRIS RD NE

Rio Grande

Lomitas Negras Arroyo

448



Prepared for:  
Southern  
Sandoval  
County  
Arroyo  
Flood  
Control  
Authority  
(SSCAFCA)



**Version 2.0**  
**December 2010**



## BARRANCA WATERSHED PARK MANAGEMENT PLAN VERSION 2.0

**NOTE:**

On December 28, 2010 (after completion of the BAWMPv2.0), SSCAFCA adopted the **Sierra Vista East Facility Plan**. The facility plan proposes diverting the entire outfall from the PdV Dam (which includes approximately 4 square miles that are currently part of the Barranca Watershed) and conveying it via storm drain to the Lomitas Negras Arroyo. The effects of this diversion on the remaining Barranca Watershed Park will be modeled in an update to the BAWMPv2.0.



BARRANCA WATERSHED PARK  
TERRAIN MAP

## Southern Sandoval County Arroyo Flood Control Authority



BOARD OF DIRECTORS

John Chaney  
Mark Conkling  
Steve House  
Donald Rudy  
Jim Fahey

Southern Sandoval County Arroyo  
Flood Control Authority  
(SSCAFCA)

Charles Thomas, P.E.  
Executive Engineer

### BARRANCA WATERSHED PARK MANAGEMENT PLAN VERSION 2.0 (BAWMPv2.0) OCTOBER 2011

The SSCAFCA Barranca Watershed Park Management Plan Version 2.0 (BAWMPv2.0) **REPLACES** the La Barranca Watershed Management Plan dated August 2006 (2006 BAWMP). Version 2.0 is a technical update converting hydrology to HEC-HMS and incorporates development changes since the original 2006 BAWMP.

Approved:

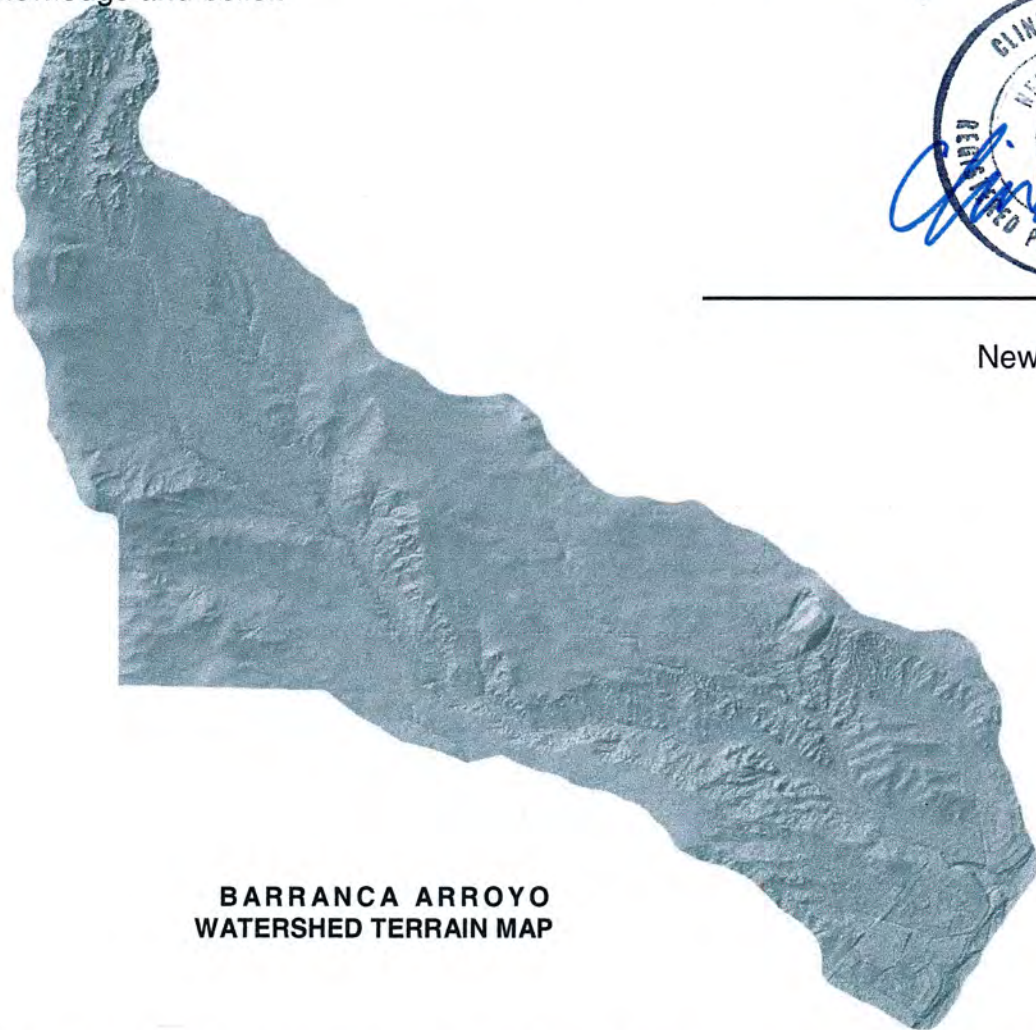
By:   
Charles Thomas, P.E. Executive Engineer

Date: November 2, 2011



## BARRANCA WATERSHED PARK MANAGEMENT PLAN VERSION 2.0

I, Clinton Dodge, Registered Professional Engineer No.6410, hereby certify that these documents were prepared by me, or directly under my supervision, and are true and correct to the best of my knowledge and belief.



BARRANCA ARROYO  
WATERSHED TERRAIN MAP

This is a planning document. Nothing herein constitutes any commitment by SSCAFCA to construct any project, study any area, acquire any right of way or enter into any contract. This watershed management plan does not obligate SSCAFCA in any way.

Drainage facility alignments, conveyance treatments, corridors, locations, rights-of-way and cost estimates are conceptual only, and may be altered or revised based upon future project analysis, changed circumstances or otherwise.

Land uses included in this document were assumed for the basis of hydrologic modeling only. This document does not grant "free discharge" from any proposed development.



Clinton Dodge, P.E.  
New Mexico P.E. No. 6410

## Southern Sandoval County Arroyo Flood Control Authority



### BOARD OF DIRECTORS

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(SSCAFCA)

David Stoliker, PE  
Executive Engineer

### BARRANCA WATERSHED PARK MANAGEMENT PLAN VERSION 2.0 (BAWMPv2.0) DECEMBER 2010

The SSCAFCA Barranca Watershed Park Management Plan Version 2.0 (BAWMPv2.0) **REPLACES** the La Barranca Watershed Management Plan dated August 2006 (2006 BAWMP). Version 2.0 is a technical update converting hydrology to HEC-HMS and incorporates development changes since the original 2006 BAWMP.

Approved:

By: David Stoliker  
David Stoliker, P.E. Executive Engineer

Date: 2-18-11 - release for public comment

CONCURRENCE:

Randall Carroll Floodplain Mgr  
City of Rio Rancho Title

Date: 3/16/11

### UNIFORM WATERSHED HYDROLOGY MAINTENANCE.

- To ensure public health, safety and welfare, SSCAFCA will develop and maintain the adopted "Master" regional hydrology for all watersheds within its jurisdiction. Updates and revisions will be made and tracked by SSCAFCA or its designee.
- A copy of the "Master" hydrology model will be available for reference or use by others. Contact SSCAFCA for the process to obtain copies of the model and see the SSCAFCA website for the Watershed Management Plan status. Use of electronic media provided by SSCAFCA is solely at the user's risk.

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December 2010



**BARRANCA WATERSHED PARK MANAGEMENT PLAN (BAWMP) REVISION HISTORY**

**CURRENT THROUGH NOVEMBER 2010**

Revision	Type	Title	Description of Changes	Prepared by	SSCAFCA BAWMP	Effective Date and Approval Date
v.1 2006	Initial Release	La Barranca Watershed Management Plan (BAWMP)	n/a	ASCG	n/a	August 2006 8/18/2006
v.2.0 December, 2010	Re-Release	Barranca Watershed Park Management Plan (previously identified as La Barranca) (BAWMP v2.0)	1. UPDATED: Conversion to HEC-HMS per the SSCAFCA 2009 DPM Requirements. Addition of V. Sue Cleveland HS and Guadalajara SD Basin developments. 2. Adjustments of basin size for 320 acre maximum, minor changes to sub-basin divides, areas and hydrology paramaters (See annotations in HMS Model)	WHPacific	12/10/2010	December, 2010

**UNIFORM WATERSHED HYDROLOGY MAINTENANCE**

- A. To ensure public health, safety and welfare, SSCAFCA will develop and maintain the adopted “Master” regional hydrology for all watersheds within its jurisdiction. Updates and revisions will be made and tracked by SSCAFCA or its designee.\
- B. A copy of the “Master” hydrology model will be available for reference or use by others. Contact SSCAFCA for the process to obtain copies of the model and see the SSCAFCA website for the Watershed Management Plan status. Use of electronic media provided by SSCAFCA is solely at the user’s risk.
- C. Watershed “Hierarchy.” SSCAFCA has established a planning hierarchy for consistency. See SSCAFCA for details.



**BARRANCA WATERSHED PARK MANAGEMENT PLAN**

(Also identified as BARRANCA ARROYO WATERSHED MANAGEMENT PLAN)

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**BARRANCA WATERSHED PARK MANAGEMENT PLAN  
ABBREVIATIONS & DEFINITIONS**

100-year Storm	A storm which has a 1% chance of being equaled or exceeded in any given year.	Extended Detention	Detaining storm water for an extended period to allow sunlight, wind action, etc., to reduce pollutants and/or to reduce the discharge rate significantly below historic for downstream protection and/or reduced ROW.
2006 BAWMP	The original La Barranca Watershed Plan accepted by SSCAFCA in August 2006.	Facility	Any structure, levee, dike, diversion channel, storm drain, pond, pumping station, detention facility or dam, either natural or manmade, which has the function of conveying, containing, directing or storing storm water runoff.
Ac	Acre	Facility Name	The commonly referenced name for the facility.
AF	acre-feet of runoff (volume of water covering one acre, one foot deep)	Facility Plan	A drainage study or design analysis of a specific facility, usually limited to a specific drainage basin or sub-basin. More detailed than a Drainage Master Plan or Watershed Management Plan.
AHYMO	Arid Regions Hydrologic Model	FEMA	Federal Emergency Management Agency
AMAFCA	Albuquerque Metropolitan Arroyo and Flood Control Authority	FIRM	Flood Insurance Rate Map
Antiquated Platting	Areas platted as part of Rio Rancho Estates in the 1960s. Typically used to identify vacant properties.	Floatables	Foreign matter such as litter and vegetative debris in storm water runoff that may float or remain suspended.
Arroyo	Ephemeral stream in arid or semiarid southwestern U.S. typically with a flat floored channel and vertical or steeply cut banks that is usually dry.	Flood	A general and temporary condition of partial or complete inundation of two or more acres of normally dry land or two or more properties from: <ul style="list-style-type: none"> <li>• Overflow of inland or tidal waters</li> <li>• Unusual and rapid accumulation or runoff of surface waters from any source</li> <li>• Mud flow.</li> </ul>
Authority	Means SSCAFCA	Floodplain	Any land area susceptible to being inundated by flood waters from any source. (FEMA Definition) Watercourse and adjacent land areas required to safely transport or store the design runoff (SSCAFCA Definition). As used in this study, the design storm is the 100-year storm.
BARD XX	Barranca Arroyo reference document number XX. See reference documents opposite Figure 2 in Figures Appendix.	Floodway	The area of a watercourse and the adjacent areas that must be reserved to discharge the 100-year storm runoff without cumulatively increasing the water surface elevation more than a designated height.
BAWMP	Barranca Arroyo Watershed Management Plan	fps	feet per second
BAWMPv2.0	Barranca Arroyo Watershed Management Plan Version 2.0 dated February 2010.	Free Discharge	Runoff without peak flow and/or volume attenuation.
BMP	Best Management Practice	Fully Developed	All areas are assumed to be completely developed (i.e. fully built out) based on existing platting, zoning and/or proposed developments, including any undeveloped areas. Calculations for undeveloped areas assume mid-range densities and/or a public bodies population and development projections and guidelines including existing zoning and platting.
BLVD	Boulevard	GIS	Geographic Information System
Category	The development category of a facility: Existing, Proposed, Upgrade, or Natural	Gross Pollutants	Larger particles of litter, vegetative debris, floatable debris and coarse sediments in storm water runoff.
CBC	Concrete Box Culvert	Hard Lined Channel	Constructed channel, storm drain or other conveyance system with non-pervious lining. (concrete, soil cement, etc.)
cfs	cubic feet per second – flow rate	HBP	Hydrograph Based Planning
cfs/Ac	cubic feet per second per acre	HEC-HMS	Hydrologic Engineering Center - Hydrologic Modeling System, computer system designed to simulate the precipitation-runoff processes of dendritic watershed systems.
Classification	Grouping of proposed and existing facilities in a context, which is used to prioritize funding needs or other administrative activity.	Historic	Prior to Rio Rancho Estates platting.
Clear Water	Discharge-Runoff with minimal sediment (3% or less)	Lateral Erosion Envelope (LEE)	An identified envelope boundary, inside of which development may be at increased risk from flooding, erosion or damage due to lateral migration of the arroyo or channel.
CMP	Corrugated Metal Pipe	Litter	Human derived trash and debris.
COA	City of Albuquerque	Major Drainage Basin	Drainage basins within a given watershed, which define the runoff into trunk or major facilities.
CORR	City of Rio Rancho	Major Facility	Facilities which collect, divert or convey a peak discharge of more than 50 cfs or store more than 2 AF of runoff from the 100-year storm.
CWD	Corrales Watershed District	MRGCD	Middle Rio Grande Conservancy District
CY	Cubic yard		
Dam	Facility intended for sediment, erosion, and flood control, which is constructed more than 10 feet in height or can store more than 10 ac-ft of water. (Note that all dams may not require OSE permits)		
Design Q	The flow rate in cfs that the facility was designed for. This assumes that freeboard and other factors were included in the design. This is not the "bank full" capacity.		
Developed	Lot, parcel or area with structures or other constructed facilities.		
Detention	Collection, temporary storage and controlled release of runoff.		
DEVEX	Developed conditions/existing platting/existing facilities		
DEVEX08	DEVEX with existing platting and existing facilities as of 2008		
DMP	Drainage Master Plan		
DPM	SSCAFCA 2009 Development Process Manual Chapter 22		
Drainage Basin	Runoff areas, which flow to a specific location or facility.		
Drainage Report	A document for the purpose of describing the existing drainage conditions, predicting the effects of land use or other changes and proposing solutions to address the drainage environment.		
du/ac	Dwelling unit per acre		
Emergency Spillway	A Spillway designed to convey excess runoff through, over or around a dam if the capacity of the dam and principal spillway are exceeded.		
EPA	Environmental Protection Agency		
Existing Condition	Current development based on existing vacant antiquated platting, surface modifications and construction in place at the time of interest.		



MS4 Municipal Separate Storm Sewer System  
Natural Existing historic arroyo or drainage course in the currently evolved natural state  
Conveyance established by natural forces.  
Naturalistic Constructed channel, swale or other conveyance system designed, and operated to  
Conveyance maintain the appearance and aesthetic feel of a natural system. (native soils, native  
vegetation, meanders, variable widths, variable slopes, etc.)  
NM New Mexico  
NMDOT New Mexico Department of Transportation  
NMSHTD New Mexico State Highway and Transportation Department  
NOAA National Oceanographic and Atmospheric Administration  
Non-Structural Drainage and water quality management practices such as education programs that  
BMP do not depend on physical structures.  
NPDES National Pollutant Discharge Elimination System. EPA permit program to  
reduce pollution in waters of the US.  
NRCS Natural Resources Conservation Service  
O&M Operation and Maintenance  
O&M Agency The agency with primary operations and maintenance responsibility for the facility.  
Obsolete Platting Antiquated Platting  
OSE Office of the State Engineer  
PdV Paseo del Volcan  
PNM Public Service Company of New Mexico  
Pond Facility intended for sediment, erosion, and flood control, which is constructed less than  
10 feet in height or stores less than 10 ac-ft of water.  
Probable (PMP) Theoretically, the greatest depth of precipitation for a given duration that is  
Maximum physically possible over a given size storm area at a particular location during a certain  
Precipitation time of year.  
Proposed A new recommended facility (as differentiated from the upgrade of an  
Facility existing facility).  
Q Flow rate, cfs  
QOL Quality of Life  
Qxxx Flow rate for xxx return frequency storm.  
R HEC-HMS Storage Coefficient  
RCP Reinforced Concrete Pipe  
RD Reference Document  
ROW Right-of-way  
RRPS Rio Rancho Public School  
RT Return Frequency - An event with a probability 1 divided by RT occurring or being  
exceeded in any given year.  
SAD Special Assessment District  
Sediment Watershed Management to reduce damage to the water course, facilities or adjacent  
Control property due to lack of channel stability  
SFR Single Family Residential dwellings in "antiquated platting."  
SHPO State Historic Preservation Office  
SLO State Land Office  
SM Square mile  
Soft Lined Constructed channel, swale or other conveyance system with pervious lining, with or  
Conveyance without erosion control measures. (i.e. riprap, grass, natural soil, etc.)  
SSCAFCA Southern Sandoval County Arroyo Flood Control Authority  
Storm Water Pond A facility intended for sediment, erosion, and flood control, which is  
constructed less than 10 feet in height and can store less than 10 ac-ft of water.  
Storm water Collection and storage of runoff without release  
Retention

SWMP Storm Water Management Program  
SWQ Storm water Quality  
SWQV Storm water Quality Volume  
Upgrade (U) The proposed improvement or upgrade of an existing facility.  
USACE United States Army Corps of Engineers  
USGS United States Geological Survey  
Ultimate Representing full build out with Watershed Plan proposed facilities.  
Development  
UNM University of New Mexico  
VBH Volume Based Hydrology.  
Vwq Storm Water quality treatment volume  
WSUD Water Sensitive Urban Design (see www.wsud.org). A philosophical approach to urban  
planning and design that aims to minimize the hydrological impacts of urban development  
on the surrounding environment.  
Watershed A comprehensive drainage area usually incorporating several drainage basins, typically  
with an outfall directly to the Rio Grande or into an independent system which conveys  
the watershed runoff to the Rio Grande.  
Watershed A comprehensive study of the drainage characteristics of a watershed establishing  
Management the plan for managing drainage within the watershed. (also referred to as Drainage  
Plan (WMP) Management Plan)  
Watershed Park Comprehensive and continuous system of trails, natural areas and recreational venues.  
YY\_WW\_ZZX Facility Identifier (Reduced version of GIS database Identifier)  
YY – Section Number (All within Township 12N 13N Range 2E and 3E for Barranca  
Arroyo Watershed)  
WW – Watershed Identifier  
BA – Barranca Arroyo Watershed  
BL – Black Arroyo Watershed  
CA – Calabacillas Arroyo Watershed  
CO – Coronado State Park Watershed  
CE – Corrales East of Main Canal Watershed  
CW – Corrales West of Main Canal Watershed  
MO – Montoyas Arroyo Watershed  
NM – NM 528 Watershed  
RR – Rio Rancho Urban Center Watershed  
UN – Unnamed Arroyo Watershed  
UW – Un-named Wash Watershed  
VE – Venada Arroyo Watershed  
ZI – Zia Watershed  
ZZ- Facility Number within Section YY  
X – Type of Facility  
A – Natural Arroyo B – Bank Protection P-Pond  
C – Channel D – Dam S-Storm Drain  
E – Environmental G – Grade Control V-Vegetation  
I – MRGCD Irrigation Structure L – MRGCD Drain  
Ditch  
X-Crossing Structure M – Pump Station O – O&M Facility  
R-SSCAFCA Rain Gauge N-Facility Plan



**BARRANCA WATERSHED PARK MANAGEMENT PLAN VERSION 2.0  
BACKGROUND  
(Also identified as Barranca Arroyo Watershed Management Plan)  
(Version 2.0 replaces the original 2006 Watershed Plan)**

The Barranca Arroyo Watershed Management Plan Version 2.0 (BAWMPv2.0) dated September is a technical update and **replaces** the original 2006 La Barranca Watershed Management Plan (2006 BAWMP). The philosophy and framework of the Watershed Plan developed in the 2006 BAWMP are incorporated in BAWMPv2.0. Maps, facility plans, and facility data and hydrology information are contained in Figures Appendix, Facilities Appendix and HMS Appendix.

The primary revisions and updates to the original 2006 BAWMP include:

- Conversion of the hydrology computational procedure to conform with the 2009 SSCAFCA DPM (BARD #40) including:
  - HEC-HMS v3.4 hydrology model with NOAA Atlas 14 Rainfall.
  - Updates to sub-basin parameters and routing characteristics.
  - Re-defining some sub-basins to restrict the size to greater than 40 acres, less than 320 acres and with a length to width ratio less than 4.
- Incorporation of 2009 SSCAFCA Development Process Manual (DPM) Chapter 22 criteria.
- Update the fully built-out land use condition with existing “antiquated” platting and existing drainage facilities to 2008 conditions (DEVEX08).
- Incorporation of City Center Facility Plan, Upper SLO and PdV Dam Footprints and deletion of the Progress, Nadine ‘Y’ and Idalia Dam sites.
- Major developments since the 2006 BAWMP that are incorporated in BAWMPv2.0 include:
  - V. Sue Cleveland High School just north of Paseo del Volcan (PDV) and the Guadalajara Storm Drain Phase IA located south of Kim Rd. and west of NM 528.
- Establishment of a process for Uniform Watershed Hydrology Maintenance:
  - A. To ensure public health, safety and welfare, SSCAFCA will develop and maintain the adopted “Master” regional HEC-HMS hydrology for watersheds within its jurisdiction. Updates and revisions will be made by SSCAFCA or its designee.
  - B. A copy of the “Master” HEC-HMS model will be available for reference by others as described on the SSCAFCA website. Note that use of electronic media provided by SSCAFCA is solely at the user’s risk.

The plan includes:

Facilities and facility data are shown on the maps in the Facilities Appendix. The Plan includes:

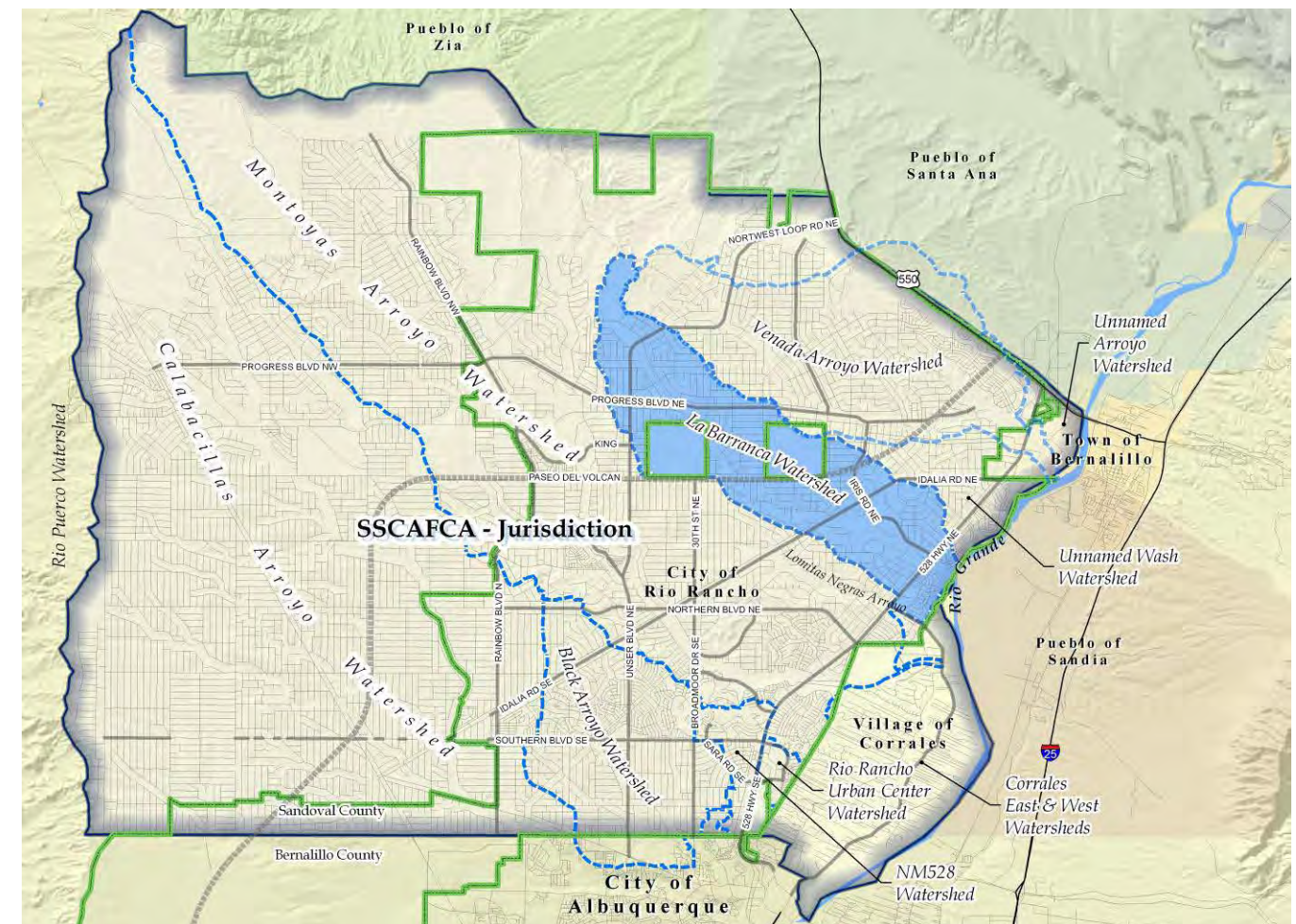
- Recommendations for a comprehensive long range regional flood control plan:
  - Lateral Erosion Envelope (LEE) implementation in accordance with the DPM,
  - Detention facilities located throughout the watershed providing:
    - Extended Detention for maximum reduction of flow rate to reduce ROW requirements, provide storm water quality and improve safety,
    - Opportunities for local multiple uses and phasing flexibility.
- In addition to flood control, the Plan identifies:
  - Storm water quality facilities prior to discharge to the Rio Grande,
  - Opportunities for public/private cost share,
  - Consideration of multiple uses, such as the Watershed Park.

- Non-structural components to implement the BAWMP include:
  - A program to maintain a “Master” hydrologic model.
  - Continue the on-going community advocacy program .
  - Consideration of alternative drainage easements, conservation easements, wildlife corridors, etc.

Watershed Description:

The Barranca Arroyo drains the area from west of Unser Boulevard southeastward to the Rio Grande, all in Rio Rancho, shown on the Location Map below.

- Area – 11 square miles
- Main Branch length – 9 miles, Average Main Branch slope – 2%
- Elevation difference – 1020 ft. (Elevation 6060 at headwaters, 5040 at Rio Grande)
- Portion of watershed with antiquated platting – 70%
- Estimated portion developed – 11% in 2003; 17% in 2008
- See Status Map Opposite Figure 1 in Figures Appendix for existing development



**EXHIBIT 1 - Barranca Arroyo Watershed Location**



**BARRANCA WATERSHED PARK MANAGEMENT PLAN VERSION 2.0  
DECEMBER 2010**

**I. INTRODUCTION**

The original 2006 Barranca Arroyo Watershed Management Plan (2006 BAWMP) was prepared for the Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA) in conjunction with the City of Rio Rancho and other stakeholders within the watershed and accepted by SSCAFCA in August 2006. Version 2.0 (BAWMPv2.0) is a technical update to add HEC-HMS hydrology, update land uses to account for recent developments and identify alternative drainage control techniques.

The primary revisions and updates incorporated in BAWMPv2.0 include:

- Hydrology revision from AHYMO to HEC-HMS v3.4, NOAA Atlas 14 Rainfall and minor updates to sub-basin parameters and routing characteristics.
- Incorporation of the 2009 SSCAFCA Development Process Manual (DPM) Chapter 22 criteria incorporating the 2008 SSCAFCA Drainage Policy.
- Update to 2008 conditions. Major developments since the 2006 BAWMP include V. Sue Cleveland High School, Guadalajara Storm Drain Phase IA and City Center Facility Plan (Draft, January 2010).
- Establishment of a uniform regional HEC-HMS hydrology system:
  - SSCAFCA will develop and maintain the official BAWMP regional hydrology.
  - A “master” HEC-HMS model will be maintained by SSCAFCA and available for use by others. Use of electronic media provided by SSCAFCA is solely at the user’s risk.
  - This model will be updated and revisions tracked by SSCAFCA.

The watershed encompasses approximately 11 square miles, is located in Rio Rancho, New Mexico, and is shown on the map in the Executive Summary and on Figures 1 and 2. Supplemental data is included in the Figures, Facilities, and HMS Appendices. Photographs of existing arroyos and facilities are shown throughout the report.

Note that the arroyo name has been changed from “La Barranca” in the 2006 BAWMP to “Barranca Arroyo” for version 2.0.

This report addresses only the reach of the arroyo upstream of NM 528. The arroyo reach between NM 528 and the Rio Grande is the subject of a separate investigation – the “Lower La Barranca Drainage Facility Plan” (BARD 10) (Note – BARD xx refers to Reference Documents listed opposite Figure 2, Reference Map in Figures Appendix)

**A. REPORT LAYOUT**

The Report layout consists of the following:

The development of the management plan is summarized in:

- Section I, - Introduction with purpose and objectives.

- Section II – Watershed Overview.
- Section III - Management Plan Development.

- The proposed plan to manage drainage within the watershed is summarized in:
  - Section IV – Barranca Arroyo Management Plan Implementation Policies, Procedures, Standards, and Strategies.
  - Section V – Barranca Arroyo Management Plan Implementation Facilities.
- Figures Appendix.
  - Figures 1 through 8 provide overall watershed data.
- Facilities Appendix. The Facilities tab includes:
  - Existing and proposed facilities are shown on the Drainage Facilities Maps 1 through 7 with technical data on the Facility Data Tables opposite each map.
- HMS Appendix. The HMS tab includes:
  - HMS schematic
  - SSCAFCA Design Rainfall
  - HMS Input Parameters
  - HMS Output (Global Summary)
- Digital report and HMS Files

**B. PURPOSE AND OBJECTIVES**

The purpose of the Barranca Watershed Park Management Plan is to implement the SSCAFCA Mission and Goals:

Protect citizens and property by implementing proven flood control solutions that:

- **manage** our watersheds prudently for future generations
- **enhance** the quality of life
- **create** the most appealing multi-use facilities
- **set** an example of quality, integrity, leadership, and professionalism
- **educate** the public concerning flood hazards
- **administer** public funds prudently

The objective of the Barranca Arroyo Watershed Management Plan is to:

- Establish a long-range regional plan for drainage management within the Barranca Arroyo Watershed such that flood protection is provided when ultimate development occurs and the plan is fully implemented. The plan will be implemented over time as development occurs and funding is available.





Photo 1 – Barranca Arroyo East of Idalia Rd.  
(Sandia Mountains in the background)

- Provide the basis for design and review. As development occurs, the BAWMP will provide the basis for facility design and agency review minimizing incompatible facilities, unnecessary future ROW costs and other “haphazard” development problems.
- Provide the opportunity to plan the watershed in advance of development. This plan is developed to address the watershed drainage issues in a cohesive, regional manner to identify and implement the best drainage solution for the community as a whole.
- Incorporate watershed stakeholders’ input and develop support. The BAWMP is the result of a collaborative process involving the many public and private parties who have an interest in the watershed.
- Establish a framework for drainage management including:
  - Watershed management criteria and goals.
  - Watershed and drainage basin boundaries and hydrology.
  - Existing drainage facility identification and capacity.
  - Arroyo safety.
  - Incorporation of Watershed Park multi-use components.
- Potential right of way requirements.
- Proposed future ultimate facilities.
- Storm water quality facilities.
- Address active development in the watershed, including:
  - Identify alternate facility opportunities for implementation flexibility,
  - On-going single family residential construction between Idalia Rd. and NM 528,
  - The development of the two State Land Office parcels including schools, commercial, university, and residential developments, as well as the new City of Rio Rancho City Hall complex,
  - The construction of Paseo del Volcan (PdV) and
  - Mariposa Ranch Development.
- Develop recommendations and an implementation plan incorporating:
  - Recommended revision to policies, procedures and standards to implement the BAWMP (Section IV).
  - Proposed major drainage facilities (Section V).
  - Recommendations summary (Section VI)



### C. PUBLIC INPUT

A Technical Team was formed to assist in development of the 2006 BAWMP. This cooperative venture was initiated by SSCAFCA to assimilate the visions and goals of stakeholders in the watershed into an overall watershed drainage strategy. The Technical Team consisted of representatives from SSCAFCA, City of Rio Rancho, Mariposa Development, State Land Office and local developers.

The team met four times to establish common goals and provide oversight for the 2006 BAWMP development. The team concurred on the principles, criteria and vision for the BAWMP, the hydrologic approach and on the selected option. Technical team meeting notes and list of participants are included in the 2006 Appendix 'C'.

Presentations and discussions at three SSCAFCA Board of Directors public meetings, a meeting with Rio Rancho staff, a meeting with local developers and builders and a public "open house" meeting were conducted to obtain input and comment regarding the BAWMP. Meeting notes from these are included in the 2006 Appendix 'C'.



Photo 2 - Idalia Rd. looking south into Barranca Arroyo Watershed  
(Waste Management Landfill on the horizon)

### D. CURRENT DEVELOPMENT ACTIVITIES

Three major developments have occurred since the 2006 BAWMP, the V. Sue Cleveland High School in SLO Section 32, Guadalajara Storm Drain and the City Center development in SLO Section 36.

- V. Sue Cleveland High School ( Facilities Map 3 & BARD#32)  
The High School site development revised the sub-basin configuration to conform to interior development. The discharge locations conform to the 2006 BAWMP and the PdV crossing locations. The PdV Crossing 'E' Flood Control Pond proposed in the 2006 BAWMP was incorporated into the school development limiting the discharge at the 2-48" culverts under PdV to their capacity. At PdV Crossing 'D', at the southwestern corner of the site, a storm water quality pond was constructed. The school site drainage at this location matches the existing discharge and the PdV Crossing 'D' Dam proposed in the 2006 BAWMP was not constructed.
- Guadalajara Storm Drain (Facilities Map 6a & BARD #24)  
A storm drain to collect local flows was constructed following damage from the 2006 storm season.
- City Center & SLO Section 36 (Facilities Map 2 & BARD #25 and BARD #34)  
At the time of the BAWMPv2.0 report, the City Center and Campus Center area was in the final stages of construction. The data incorporated into BAWMPv2.0 is based on the sited references, but may not conform to the final development.

The southern portion of SLO Section 36 including City Hall, Santa Ana Event Center, the Hewitt Packard development and the UNM campus area drains to the Lomitas Negras watershed and is proposed for diversion at PdV to the Barranca Arroyo (see Section III.D and Facility Map 2).



## II. WATERSHED OVERVIEW

### A. WATERSHED CHARACTERISTICS

The Barranca Arroyo Watershed drains to the Rio Grande and is south of the Venada Arroyo Watershed and north of the Montoyas Arroyo Watershed. See Figure 1, SSCAFCA Jurisdictional Map, and Figure 2, Location/Reference Map, in Figures Appendix. The watershed drains approximately 11 square miles of developing upland area upstream of NM 528 with a main arroyo branch length of approximately 9 miles.

The Barranca Arroyo Watershed is characterized in four segments.

- Mariposa. The Mariposa segment extends from the headwaters to Unser Blvd. This reach is being developed by High Desert Investment Corporation with an approved Drainage Master Plan. The data from this development has been incorporated into the BAWMP.
- Mariposa to Paseo del Volcan (PdV). The segment above PdV extends from Unser Blvd. to Paseo del Volcan. This segment is the focus of intense development activity. The V. Sue Cleveland High School has been constructed on approximately 100 acres in the State Land Office (SLO) Section 32 just north of PdV. Planning and development of CNM and UNM campuses is underway in SLO Section 36. Also, the City Center development in the SLO Section 36 does not currently drain to the Barranca Arroyo, but a diversion of this runoff into the proposed PdV Dam and discharge to the Barranca Arroyo is part of both the 2006 BAWMP and BAWMPv2.0.
- Downstream of PdV to NM 528. This segment extends from Paseo del Volcan to NM 528. This reach is partially developed with scattered single family residences and natural arroyo conveyances. Several small local ponds located along tributaries in this reach are existing or have been approved.
- The Lower Barranca Arroyo is the reach from NM 528 to the Rio Grande. This reach consists of an earthen channel with a grade control structure. This reach is eroding and the flow is unstable at higher flow rates. This portion of the Barranca Arroyo is the subject of a detailed Drainage Facility Plan (BARD-10) and is not included in the BAWMP.

### B. EXISTING FACILITIES

- Existing development is shown on the Status Map – 2009 in the Figures Appendix.
- Existing facility details are shown in Figures Appendix on the Drainage Facilities Maps, Map 1 through 8, and the Facility Data Tables opposite each map.
- The following existing facility deficiencies were identified:
  - Main Branch culverts at Unser Blvd.
  - Main Branch culverts at Idalia Rd.

- Headcutting at several culverts including Idalia Rd. & Main Branch, Idalia Rd. & Tributary BAK, Idalia Rd. & Tributary BAJ.
- It is recommended that these deficiencies be monitored and addressed as one element of the Capital Improvement Program. Failure of one of these may result in road closures but none of these are considered immediately life threatening.
- All of the existing facilities, with the exception of a few minor structures crossing PdV, are inadequate for developed conditions without drainage controls.
- Existing Arroyos:
  - The arroyos within the watershed are natural earthen conveyances, typically with wide flat bottoms and steep or vertical sides. Some limited reaches are deeply incised where the grade is steeper and/or upstream controls have artificially steepened the grade.
  - The existing arroyos are typically meandering and evolving naturally.
  - Some high (10' to in excess of 30') vertical banks exist on the Main Branch (See Photos 17 and 18)



Photo 3 - David Stoliker and Karen Jacobsen inspect erosion Main Branch outfall at Idalia Rd.





Photo 4 - View of Main Branch looking upstream from Tributary BAJ confluence just west of Saratoga Rd.



Photo 5 – Gravel Strata in Vertical Bank (note bank swallow holes)

D. SOILS

- The soils are typically sands with a very low percentage of clay and are very erosive.
- Figure 4 in Figures Appendix is a copy of the NRCS soils data for the watershed with erodibility and other soil properties listed. Prominent soil types include:
  - 55% 142 Grieta fine sandy loam, 1% to 4% slopes
  - 30% 191 Sheppard loamy fine sand, 3% to 8% slopes.
  - 6% 183 Sheppard loamy fine sand, 8% to 15% slopes
  - 5% 211 Zia-Clovis Association, 2% to 10% slopes
  - 4% 145 Grieta-Sheppard loamy fine sands, 2% to 9% slopes

C. ENVIRONMENTAL

Environmental improvements are recommended at all levels from planning through O&M to protect existing natural habitat and to satisfy NPDES requirements. Some identified environmental concerns are:

- Burrowing owls and bank swallows are numerous in the vertical banks, particularly downstream of Idalia Rd. These are threatened and/or endangered species.
- A badger has been sighted in the watershed.
- Native vegetation is typical sparse upland forbs and grasses of the Plains Mesa Sand Scrub ecosystem. This ecosystem has been and continues to be compromised and destroyed at a rapid rate and is necessary for survival of native wildlife.
- Threatened and endangered species, species of concern, migratory birds, wetlands and state-listed noxious weeds have been identified in the area including:
  - western burrowing owl (*Athene cunicularia hypugea*)
  - prostrate prairie clover (*Dalea scariosa*)
  - Knight's milkvetch (*Astagalus knightii*)
  - Santa Fe milkvetch (*A feensis*)
- Historic and archaeologic sites have been identified in the area.



Photo 6 - Burrowing Owl in Vertical Barranca Arroyo Bank



E. 2006 STORM SEASON IMPACTS

Severe storms in 2006 occurred over portions of the watershed resulting in local erosion and limited flooding. Damage occurred on private property, graded dirt streets and in the Main Branch of the arroyo (see Photos 6a and 6b). As a result, the following improvements and upgrades were implemented in the watershed:

- Guadalajara Storm Drain Phase IA. This was a joint SSCAFCA/City/County storm drain and paving project to control runoff in the vicinity of Kim Rd. and Guadalajara Rd. This area experienced severe erosion resulting in closed roads, sediment deposition and local damage.
- Repair of the drop structure on the Main Branch east of NM 528 due to undercutting from erosion.



Photo 6a - Main Branch at Saratoga Road July 8, 2006



Photo 6b - Tributary BAK July 8, 2006



### III. MANAGEMENT PLAN DEVELOPMENT

This Section summarizes the details of the BAWMP. Supplemental data and details are in the Technical Appendix.

#### A. JURISDICTION

The watershed is within Sandoval County, the SSCAFCA jurisdiction boundary and the City of Rio Rancho as shown on Figures Appendix Figure 1.

Some other agencies with jurisdiction within the Barranca Arroyo Watershed include:

- The Army Corps of Engineers - Section 404 Permit process.
- The Office of the State Engineer - water rights and dam safety.
- The Environmental Protection Agency - the National Pollutant Discharge Elimination System (NPDES).
- State Historic Preservation Office – Cultural preservation.
- Federal Emergency Management Agency – Floodplain mapping and flood insurance.

#### B. REFERENCES

Available reports and plans for existing and proposed developments and facilities within the watershed were assembled and reviewed and have been included in the development of the BAWMP. These reference documents are shown in the text as BARD XX and are listed on the Reference Map in Figures Appendix opposite Figure 2.

#### C. CRITERIA AND CONSTRAINTS

##### 1. Criteria

The criteria recommended to manage storm water in the Barranca Arroyo watershed and used to develop the BAWMP are:

- Utilize SSCAFCA drainage policies, resolutions and related material.
- Design Storm. Utilize the 100-year 24-hour event as the design storm, except where more stringent criteria are required (i.e. dam safety).
- Plan for unrestricted single family residential (SFR) discharge in antiquated platted areas
- Sediment Bulking. Incorporate sediment bulking as follows:
  - 3% in dam outfalls.
  - 6% for developed residential with paved streets and controlled drainage.
  - 18% for undeveloped lands and development in antiquated platting without paved streets and without controlled drainage.
- Drainage Master Plans (DMPs) and Facility Plans.
  - Identify and develop DMPs or Facility Plans for all drainage facilities and for all new developments.
  - Identify and develop DMPs or Facility Plans for drainage basins with poorly defined flow paths. Some of these areas are identified in the BAWMP on the Drainage Facilities Maps 1 through 8 in Figures Appendix.

##### Storm Water Quality (SWQ).

- Provide storm water quality treatment in accordance with DPM Chapter 22 Section 10.
- Capture and treat the storm water quality volume (SWQV).
- The storm water quality volume is defined in the DPM as the runoff from a 0.6 inch 6-hour storm.



Photo 7 – Local Flora

- Treat all pollutants to the maximum extent practicable, including specifically:
  - Sediment
  - Bacteria and Coliform Bacillus
  - Floatables and Gross Pollutants
  - Other pollutants identified by SSCAFCA.
- Incorporate storm water quality facilities in all development (commercial, industrial and residential subdivisions), ponds, dams and as stand-alone facilities when required.
- Commercial and Industrial Developments – The development provides, operates and maintains on-site storm water quality facilities with access for inspection.
- Commercial, Industrial and New Subdivision Development.



- Limit the runoff rate to downstream capacity conforming to SSCAFCA Drainage Policy and DPM.
- Conveyance.
  - Protect the public, development and drainage facilities from evolving and meandering drainage courses. Utilize the LEE concept except where impractical.
  - Utilize naturalistic stabilization for arroyos, channels and other conveyance facilities to prevent erosion where it is impractical to maintain non-erosive flows.
- Facility Design.
  - Incorporate drainage plans for new subdivisions currently in development.
  - At a minimum, design drainage facilities in accordance with SSCAFCA and the City of Rio Rancho Development Process Manual (BARD 40).
  - Design non-erosive conditions for flows entering conveyances consistent with the environment of the conveyance (typically 2 fps or less for earthen channels).
  - Naturalistic Channel Treatment –
    - Maximum velocity = 2 fps.
    - Equilibrium slope = 0.1%
    - Maximum grade control drop structure height, upstream water surface to tailwater elevation = 10'
    - Scour protection = 5' minimum below equilibrium slope grade.
    - Side slopes = 4 horizontal to 1 vertical or flatter.
    - ROW line to top of channel = 15' horizontal minimum.
    - Incorporate 15' drop structure into roadway crossing structures.
- Right of Way. Estimated minimum ROW requirements:
  - Storm Drain – Either in roadway ROW or a minimum width of 50'.
  - Naturalistic Channel Treatment – LEE line except where impractical.
  - Hard Lined Channels – Recommended ROW width of 100' subject to floodplain limits, Watershed Park amenities and design.
- Watershed Park. (BARD 14)
  - Provide allowance for Watershed Park multiple-use including trails on major and secondary arroyos, park and recreational facilities, and potential utility placement in drainage corridors.
  - Incorporate the Watershed Park concept on the Main Branch, a linear parkway along the Main Branch of the Barranca Arroyo from top to bottom (from the headwaters to the Rio Grande)
  - Incorporate the Watershed Park concept on tributaries, unless impractical.



Photo 8 – Main Branch at NM 528  
2 – 14' x 10' CBC

## 2. NM 528 Constraint

After reviewing existing conditions hydrology and existing facility capacities, the following watershed management strategy was established and recommended by the Technical Team:

- Restrict the Main Branch flow at NM 528 to a target flow rate of 2,000 cfs to reduce the erosion and improve unstable arroyo conditions between NM 528 and the Rio Grande

This is less than the existing capacity of the NM 528 crossing of approximately 4,000 cfs (BARD 10). The target flow rate reduces the cost of downstream facilities, reduces erosion and environmental impacts, increases safety and provides an increased opportunity for naturalistic channel treatment. Downstream of NM 528, the flow regime was identified in the Lower La Barranca Facility Plan (BARD 10) as being unstable.

This constraint impacts the size and function of detention facilities just upstream of NM 528. To evaluate the prudence of this constraint, it is recommended that:

- Construct a physical model to evaluate the unstable flow to determine if the proposed target flow rate is adequate to improve the safety in the reach between NM 528 and the Rio Grande and/or identify feasible and prudent alternatives.
- Prepare a Facility Plan evaluating the economic impact of this constraint.





Photo 9 - Tributary BAK Following July 8, 2006 Storm

#### D. HYDROLOGY

##### 1. Development Conditions

Hydrology was developed for three development conditions:

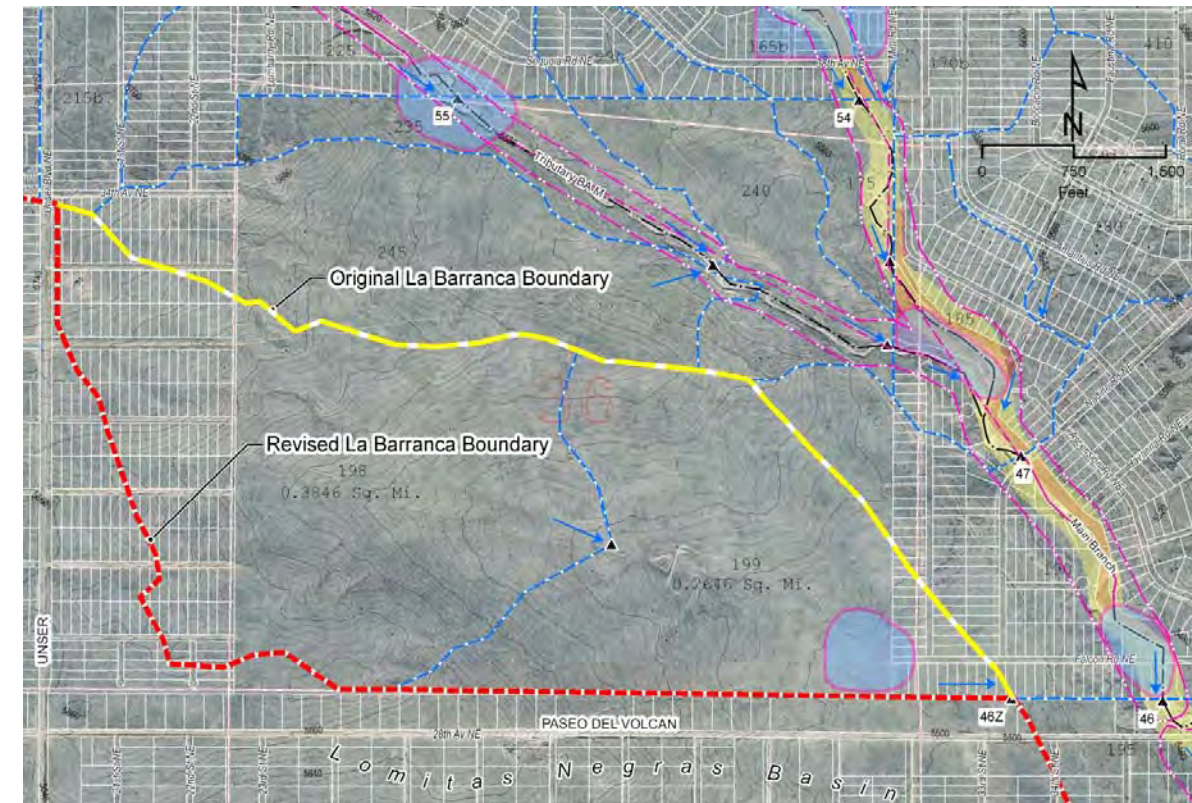
- Existing Conditions –present development, existing dirt streets, etc.
- Developed – existing facilities as of 2008 (DEVEX08) – DEVEX08 assumes full build-out development of the watershed with existing drainage facilities as of 2008 (i.e. no new dams, ponds, etc.). SFR development and associated roads and streets discharge without constraints. Used to reveal potential future deficiencies and as a basis for evaluating facility designs.
- Proposed Ultimate Conditions – Assumes full build-out development of the watershed with all proposed facilities.

##### 2. Hydrology Development

HEC-HMS hydrology for the BAWMPv2.0 was developed using the criteria in Section C and the following (a compact disk with the HEC-HMS hydrology models is bound in the back of this document):

- HEC-HMS v3.4
- SCAFCFA 2009 Development Process Manual, Chapter 22
- Land use coefficients conforming to SCAFCFA adopted standards (See DPM)
- Sub-basin sizes are, in general, greater than 40 acres and less than 320 acres to improve the correlation between AHYMO and HEC-HMS (BARD #31).
- Channel routing typically based on “naturalistic conveyance” with wide earthen channels with  $n=0.055$  for sand bottom arroyos.

- Commercial developments and new subdivisions are assumed to restrict runoff to existing flow rates (i.e. current platting and bladed roads without buildings). Volume and frequency discharge restrictions are not incorporated.
  - Water quality facilities are integrated into detention facilities. Separate water quality facilities are not incorporated into the hydrology.
3. Diversion at State Land Office (SLO) Section 36. (See Exhibit 2)
- The flow path at the southeast corner of Section 36 is a historic avulsion location with the potential for the flow to go east into the Barranca Arroyo watershed or south into the Lomitas Negras basin, depending on flow rate, sediment build up, etc.
  - The 2006 BAWMP proposed to direct this flow eastward along PdV to the Barranca Arroyo Main Branch. South of PdV, the Lomitas Negras is a broad swale without a defined arroyo and without ROW. Directing this flow to the Barranca Arroyo allows control of the runoff in the proposed PdV Dam.
  - Currently, the Lomitas Negras flow at PdV crosses the roadway and continues southward in the historic path (i.e. the flow was not directed eastward as part of the construction of PdV).
  - Planning for the development in SLO Section 36, including the discharge from the City Center, is proposed to address this issue.
  - The BAWMP ultimate conditions hydrology includes the runoff that historically flowed to the avulsion location (sub-basins 198 & 199, flow arrow ‘A’ in Exhibit 2).
  - The impact on the flow rates in the Lomitas Negras are expected to be minimal since this is a small area of the total basin.



**EXHIBIT 2**

SLO Section 36 Diversion Map

(Note: See Facilities Appendix, Drainage Facilities Map 2 for detail)



E. HMS CONVERSION

This update of the Barranca Arroyo Watershed Management Plan includes the conversion to a regional HEC-HMS hydrology model. The AHYMO hydrologic model developed in the 2006 Watershed Management Plan was updated and converted to HEC-HMS conforming to SSCAFCA policy and following the criteria in the July 2009 SSCAFCA Development Process Manual. Slight differences between the AHYMO results and the HEC-HMS results are attributed to the change to NOAA Atlas 14 rainfall, routing variations as a result of approximations in AHYMO and different unit hydrograph methods.

A comparison of AHYMO and HEC-HMS flows are included in the table below.

TABLE III-1 COMPARISON AHYMO AND HEC-HMS

EXISTING CONDITIONS

ELEMENT ID	AHYMO Q (cfs)	HEC-HMS Q (cfs)
BASIN 125	115	140
JUNCTION 415.10	138	170
BASIN 180	135	160

DEVEX CONDITIONS

ELEMENT ID	AHYMO Q (cfs)	HEC-HMS Q (cfs)
BASIN 125	168	190
JUNCTION 415.10	314	320
BASIN 180	217	230

ULTIMATE CONDITIONS

ELEMENT ID	AHYMO Q (cfs)	HEC-HMS Q (cfs)
BASIN 125	174	190
JUNCTION 415.10	325	320
BASIN 180	224	230

For additional HMS conversion details, please refer to BARD #23, BARD #31, and the HMS Appendix.

F. PLATTING AND RIGHT-OF-WAY

1. SSCAFCA Properties and Right-of-Way (ROW)

Except for the Mariposa Development and the State Land Office sections, the watershed is within the original Rio Rancho Estates Subdivision platted in the 1960s, also identified as “antiquated platting.” Right-of-way (ROW) for drainage facilities is included in some areas of the antiquated platting, but not in others. SSCAFCA owned drainage ROW is shown on Figure 7, Property/Right-of-Way Map in Figures Appendix.

2. Right-of-Way Issues and Concerns

A conceptual estimate of the conveyance ROW requirements for proposed facilities is identified on the Drainage Facilities Maps (Maps 1 through 8) in Figures Appendix) and summarized on Table V-1 in Section V.

These illustrate several ROW issues:

- The SSCAFCA ROW width is variable and quite narrow in some locations.
- In many locations, the ROW does not coincide with either the current arroyo location or the mapped floodplain.
- Several reaches of the Main Branch and numerous areas on the Tributaries do not have any ROW.
- Adequate ROW for dam sites is limited or non-existent.

3. ROW Action Plan

- An investigation at the level of a “footprint” analysis to identify ROW requirements is recommended.
  - This was accomplished in the report titled “A Comprehensive Management Strategy for Arroyo Corridors” (BARD 41) which utilized the Barranca Arroyo as an Example Study Area. This report makes the following recommendation: “RECOMMENDATIONS – BARRANCA WATERSHED EXAMPLE STUDY The recommendations presented in this Section are limited to the isolated Barranca Watershed Example Study analysis presented in this Strategy Report. Beyond these watershed specific recommendations, the SSCAFCA Jurisdiction Wide Comprehensive Management Strategies presented in Section VIII should also be implemented for this watershed.

A. Barranca LEE Line Overlay.

It is recommended that SSCAFCA officially adopt a policy regulating future development on parcels identified on Exhibit 2 through Exhibit 8 that are within or partially within the LEEMAX line. In addition, it is recommended that SSCAFCA aggressively pursue acquisition of those parcels through dedication, donation, or outright purchase. From a practical standpoint, if a parcel size is less than 1 acre, but only a portion of the lot is within the LEEMAX line, it is recommended that the entire lot be acquired. Conversely, if a portion of a large lot is within the LEE line, it is recommended that actions be undertaken to divide the parcel into areas within and area outside the LEE line, and acquisition target only the area within the LEE line. Priority should be given to the area between Paseo del Volcan and 40<sup>th</sup> St., based on the fact that at this time there are no parcels defined for the arroyo corridor in this section of the arroyo.

If this recommendation is to be implemented, a review of the potential legal ramifications should be investigated in order to limit SSCAFCA’s potential liability.”

Note that the parcel data in this report are more detailed than the BAWMPv 2.0 and should be consulted prior to acquisition or other actions.

- Identify all SSCAFCA owned property and verify it is correctly shown on SSCAFCA, City and County GIS.
  - A comprehensive SSCAFCA ROW map has been prepared (BARD #26).



- Prioritize, fund and prepare facility planning level plans to identify and support advance ROW acquisition. Recommended “High Priority” ROW for Barranca Arroyo Watershed facilities include:
  - Upper SLO Dam, Tributary BAM at SLO Section 36. Acquisition of this dam site is underway as of 2008.
  - PdV Dam, Main Branch at PdV.
  - 40<sup>th</sup> Street Dam, Main Branch at 40<sup>th</sup> St. and Tributary BAL.
  - Main Branch, PdV to 40<sup>th</sup> St.
  - Badger Dam, Main Branch below Idalia Rd.
  - Tributary BAK, Idalia to Saratoga.
  - Tributary BAP, Kim to Saratoga.
  - Saratoga Dam, Main Branch at Saratoga.
  - Main Branch, Badger Dam to Saratoga Dam.

#### 4. Property Rights Issues

- Antiquated Platted Properties  
 Properties within the antiquated platting pose unique problems. The antiquated platted lots are individually owned and the lots can be developed as single family residential dwellings (SFR) without re-platting. This situation makes acquisition of right-of-way for proposed facilities a high priority to avoid SFR development at locations of proposed facilities, either arroyo ROW or dam sites.  
 The starting point to address these properties is the Lateral Erosion Envelope (LEE) concept. The LEE concept is discussed in detail in Section III. The LEE implementation is controlled by the requirements in DPM Chapter 22, Sections C. and D with additional detail included in BARD 41.  
 For planning purposes, the LEE line for arroyos and tributaries is shown on the Drainage Facilities Maps, Maps 1 through 8 in Figures Appendix. Note that a more detailed analysis, based on individual site considerations is required at the time of individual lot development.
- Options and Policies Investigation  
 Due to the existing antiquated platting, ROW acquisition is a major funding issue for SSCAFCA. Due to this importance, it is recommended that property rights options and policies review be an on-going effort. The following are some types of property rights suggested for consideration.
  - Public Agency ownership with appropriate easements to other agencies for recreation, utilities, access, drainage, etc.
  - Drainage easements for minor flows or occasional flooding with right of access.
  - Floodplain property and construction controls conforming to FEMA regulations.
  - Identification of floodway boundaries which provide additional controls.
  - LEE line construction controls to discourage and control building of habitable structures inside the LEE line.
  - Conservation easements where the property owner agrees to not disturb an area and to maintain the area to promote wildlife, open space, etc.
  - Tax incentives for appropriate types of easements.
  - Impact fee credits for property rights.



Photo 9a – Tributary BAK downstream from Iris Rd. with rubble and fence in arroyo

## G STORM WATER QUALITY

### 1. NPDES Permit

SSCAFCA is subject to EPA National Pollutant Discharge Elimination System (NPDES) requirements and discharges storm water under the NPDES Phase II General Permit NMR040000. SSCAFCA submitted the Storm Water Management Plan (SWMP) on May 24, 2007 and has filed annual reports for Fiscal Years 2008 and 2009 (BARD #27). The Storm Water Management Plan identifies Best Management Practices (BMPs) and how the six Minimum Control Measures referenced in the SWMP will be addressed. The six control measures are:

- Public Education and Outreach
- Public Participation/Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Runoff Control
- Post-Construction Runoff Control
- Pollution Prevention/Good Housekeeping

### 2. Storm Water Quality Policy

As part of this permit, SSCAFCA has implemented a policy to treat the runoff from a 0.6” 6-hour storm event to improve runoff water quality-incorporated in the DPM (BARD 40). Implementation of the policy in the BAWMP includes.





Photo 10 - Dumped Hay in Arroyo



Photo 11 - Dumped Manure in Arroyo

- Detention facilities to allow extended detention of the SWQV. It is assumed that the extended detention discharge rate will be minor (i.e. less than 5 cfs).
- Water Quality facilities incorporated into proposed flood control ponds and dams.
- Rainwater harvesting on new SFR building sites to reduce runoff volume and frequency.
- Commercial and industrial developments provide on-site treatment, operation and maintenance as required by SSCAFCA, EPA and local jurisdiction policies and NPDES permits.
- Note that extended detention is not the only applicable treatment method. This is used in the BAWMP because it represents a conservative estimate of required ROW for planning purposes.

### 3. Micro Water Quality Pond/Park

Micro water quality ponds/parks should be considered as a water quality feature where access to water is available to sustain wetland habitat (i.e. well wash water or other “clean grey water”). This can provide enhanced treatment for low flows, wildlife habitat and educational opportunities.



Photo 12 - Roskos Field/Haynes Park Water Quality Pond/Park



## STORM WATER QUALITY CONTINUED

### 4. Gross Pollutant and Floatable Control

Reduction of gross pollutants and floatables (litter, trash, debris, etc.) is a regional water quality concern. Over 60 gross pollutant control facilities have been implemented (BARD 15) in the Middle Rio Grande area. One recommended component of the water quality volume treatment is control of gross pollutants and floatables.

### 5. Bacteria and Fecal Coliform

Reduction of fecal coliform entering the Middle Rio Grande is also a regional water quality concern. Several studies have identified the sources and transport paths for this pollutant. It is recommended that the results of these studies be coordinated with other Middle Rio Grande agencies and included in the SSCAFCA water quality program.

### 6. Non-Structural “Soft” Best Management Practices

Reducing storm water pollution at the source (i.e. do not generate any pollution) is the objective of non-structural best management practices (BMPs). These are not specific to the BAWMP, but are community-wide and regional in nature. These practices are integral to the success of the recommended structural BMPs in the BAWMP. Some non-structural BMPs include:

- Education Programs
- Rainwater harvesting
- Low impact development
- Source controls
- Recycling programs
- Dog and cat waste control
- Labels such as “Drains to River.”
- “Keep Rio Rancho Beautiful” and similar programs.



Photo 13 - Gross Pollutant and Floatable Control Facility

## H. LATERAL EROSION ENVELOPE (LEE)

One objective of the BAWMP is to protect the public, existing and new development and existing drainage facilities from evolving drainage courses and patterns until permanent stable facilities are operational. Consistent with the Black Arroyo, the Montoyas Arroyo and the Venada Arroyo Watershed Management Plans, the Lateral Erosion Envelope (LEE) is recommended as the implementation strategy to manage areas of increased risk due to erosion and meander of the natural arroyo. A detailed LEE line study was conducted for the Barranca Arroyo (BARD 41) and includes a detailed analysis of LEE line impacts for the Barranca Arroyo. The maps in this report (BARD 41) should be consulted prior to taking action based on the LEE Line (See Section III F).

### 1. Analysis.

The existing unlined arroyos and drainage courses within the watershed are active storm water drainage ways subject to continued erosion and deposition effecting the location, course, lateral migration and depth of the arroyo. The altered course of the arroyo may damage property and structures and endanger lives. The proposed methodology to estimate the extent of the lateral migration of the arroyo is the Lateral Erosion Envelope (LEE). This is a straightforward analysis process and is a current local practice of estimating the extent of lateral migration. The LEE defines an estimated boundary within which the arroyo is predicted to meander and laterally



migrate. Note that this process is an imprecise system based in part on empirical data and it is recognized that natural processes may not react as predicted.

Also, as upstream areas develop, the runoff will be “sediment starved” resulting in head cutting and erosion. In the long term, this erosion will require some stabilization of the conveyance.



Photo 14 - House possibly in lateral erosion limit

## 2. Development Risk

The LEE shown on the Drainage Facilities Maps in Figures Appendix is an estimate of those areas adjacent to arroyos where development is at increased risk due to arroyo erosion, sedimentation and meander. The basis for development of the LEE is the SSCAFCA Sediment and Erosion Design Guide (BARD 21). Flow rates representing developed single family residential conditions with existing platting (DEVEX) are used to estimate the LEE. The location of the arroyo is estimated from aerial photography dated July 2003.

## 3. Field Confirmation

The LEE shown in the BAWMP is an approximation based on available data. Field confirmation of the LEE by a qualified professional prior to development of a parcel within the LEE or in the vicinity of the LEE is recommended. This confirmation inspection and public agency review should be paid for by the development and should consider changes in the arroyo since the date of the mapping, the specific property location relative to the average arroyo downstream centerline, local geology, potential effects of nearby developments and other local factors affecting the LEE at each particular site.

## 4. Updates

When updated survey or aerial photography is available (the BAWMP is based on 2003 photography) this data should be used to confirm, update or supplement the LEE limits. The data available in the Geographic Information System (GIS) for property lines and platting is of unknown accuracy. It is possible that a specific property relationship to the LEE is incorrectly shown due to mapping uncertainties. It is recommended that the platting data be verified to tie together the platting, aerial and GIS coordinate systems to minimize these confusions.

## 5. Limit of Study

The upstream limit of the LEE study is indicated on the Drainage Facilities Maps in the Facilities Appendix. This limit is based on two criteria; a flow rate greater than approximately 120 cfs (representative of approximately 50 acres) or an identified conveyance based on aerial photography or field data. It is probable that erosion and sedimentation of unknown magnitude will occur upstream from the limit of the study. Also, this flow rate may be higher than the capacity of local conveyance facilities.

## 6. Implementation

For antiquated platted areas with SFR development, a policy controlling development within the LEE line is recommended. If development is proposed within the LEE line, it is recommended that dwellings be elevated above the water surface, erosion protection provided for appropriate structures, and the increased risk be acknowledged by the builder/developer in such a manner that the information passes on to future owners. In new platted and re-platted areas, the drainage conveyance ROW, including the LEE line, drainage improvements, etc., should be addressed as part of the re-platting process.

### I. NATURALISTIC CONVEYANCE

The Management Plan recommends maintaining natural appearing stable conveyance where feasible. “Hard Lining” of the channels, (such as a trapezoidal concrete channel) is only proposed where other treatments are not feasible due to high flow rates, high velocities or limited ROW. It is also recommended that naturalistic conveyance design guidelines be developed, perhaps in conjunction with Watershed Park implementation strategies.

Naturalistic conveyance treatment offers many advantages over hard lined channels:

- Can be implemented over time, one structure at a time, as development occurs, funding becomes available or erosion becomes a safety issue.
- Provides opportunity for Watershed Park quality of life amenities such as wildlife habitat, aesthetics, open space, native vegetation, trails, etc.
- Provides educational opportunities for evolution of arroyos, environmental impacts, wildlife and habitat interaction, etc.



- Multiple use corridors promote community “ownership” and increased appreciation of public drainage control facilities.

The “Comprehensive Management Strategy for Arroyo Corridors” (BARD #41) identifies grade control structures as the recommended engineering control in Section VII subsection B as follows:

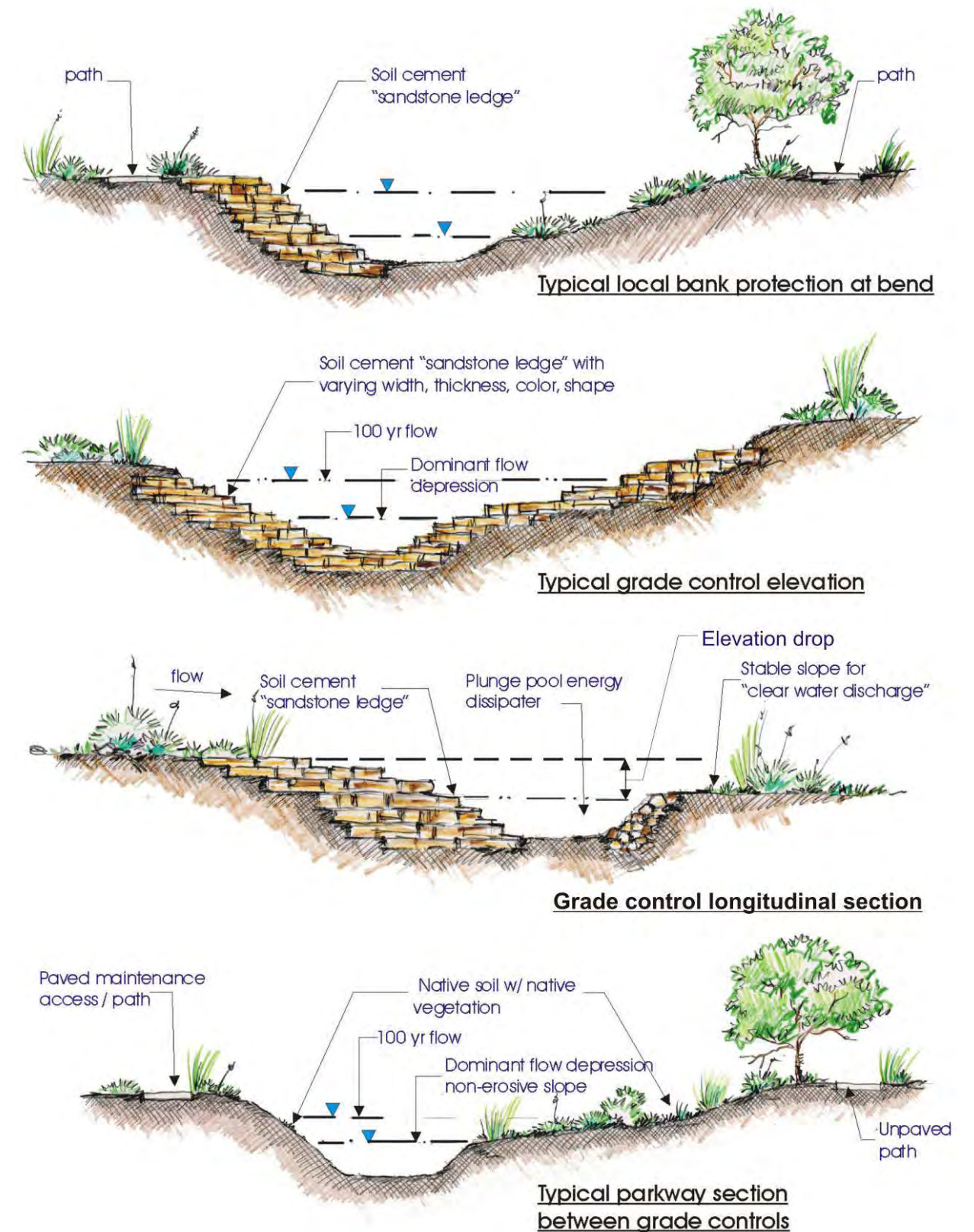
“The primary recommended engineering control for the Barranca is the implementation of grade control structures. At first thought, construction of grade control structures may seem counter-intuitive to maintaining a naturalistic arroyo. However, as development continues in the watershed without some form of horizontal and vertical control, the arroyo will continue to evolve into an even more incised channel and threaten existing and future structures.

The equilibrium slope / grade control spacing analysis presented in Sections V.C and VI.B, discuss anticipated future spacing based on both the existing conditions hydrology and the DEVEX hydrology. Since it is recommended that the analysis is periodically updated, preliminary recommendations have been prepared for locating grade control structures based on the existing conditions hydrology. The locations of the structures recommended are shown on Exhibit 1. As the flows increase due to future development the analysis can be updated and the spacing revisited.

The spacing of the grade control was approximated based on the information provided in Section VI.B which assumes a 5’ maximum drop, as well as currently established vertical controls locations (NM 528, Idalia Road, and Paseo del Volcan). It should be noted that the recommendation for grade control does not require all structures to be in place simultaneously. They can be planned over a long term project implementation time-frame.”

This recommendation is consistent with the BAWMP v 2.0.

- Erosion control drop structures. It is proposed to flatten the arroyo slopes using natural appearing drop structures and grade control structures to slow the velocity and control erosion. Grade controls can be constructed of colored soil cement, riprap or other “natural” materials with variable slopes, thicknesses, widths and colors, installed to appear like natural geologic formations such as sandstone ledges or hard clay strata. Channel wall stabilization will be necessary in certain locations to prevent lateral erosion and migration of the arroyo using similar “natural” structures.
- Equilibrium slopes. This concept assumes that the stabilized channels will follow typical meander patterns and typically be wide, flat, and shallow, similar to many of the natural arroyos. Also, this concept requires channel slopes between the grade controls flat enough for clear water discharge to be non-erosive. For the sandy soils in the watershed, this slope is very flat, probably less than 5 feet per mile.



**EXHIBIT 3 - Naturalistic Treatment Concepts**



3. ROW. The naturalistic conveyance ROW estimates are based on acquisition or control of the width needed using the criteria in Section III E with 5' high drop structures plus 30' for access, trails, etc. Secondary access ROW for maintenance of grade control structures may be required in some instances.
4. One naturalistic concept is shown on the sketches on this page.
5. Limitations. Not all arroyos are amenable to naturalistic treatment. In particular, naturalistic arroyos with large flows or multiple crossings may be impractical. Also, as the flows increase, the width of the arroyo must increase to maintain non-erosive velocities.

Table III-2 lists rough rule-of-thumb estimates for naturalistic, LEE and hard lined conveyance. As shown, flow rates in excess of approximately 1,100 cfs require very wide naturalistic channels and grade control structures to avoid erosion.

**TABLE III-2  
CONCEPTUAL CONVEYANCE TREATMENT COMPARISON**

CONVEYANCE TYPE	650 CFS FLOW			1100 CFS FLOW		
	Bottom Width	ROW Width	Channel Cost of length/Ft.	Bottom Width	ROW Width	Channel Cost of length/Ft
Naturalistic						
w/ 5' Drop Str.	100'	210'	\$340	200'	310'	\$560
w/ 10' Drop Str.	100'	250'	\$400	200'	350'	\$660
LEE Line w/o drop structures	100'	300'	\$210	200'	440'	\$100
Hard Lined	10'	100'	\$480	20'	100'	\$500

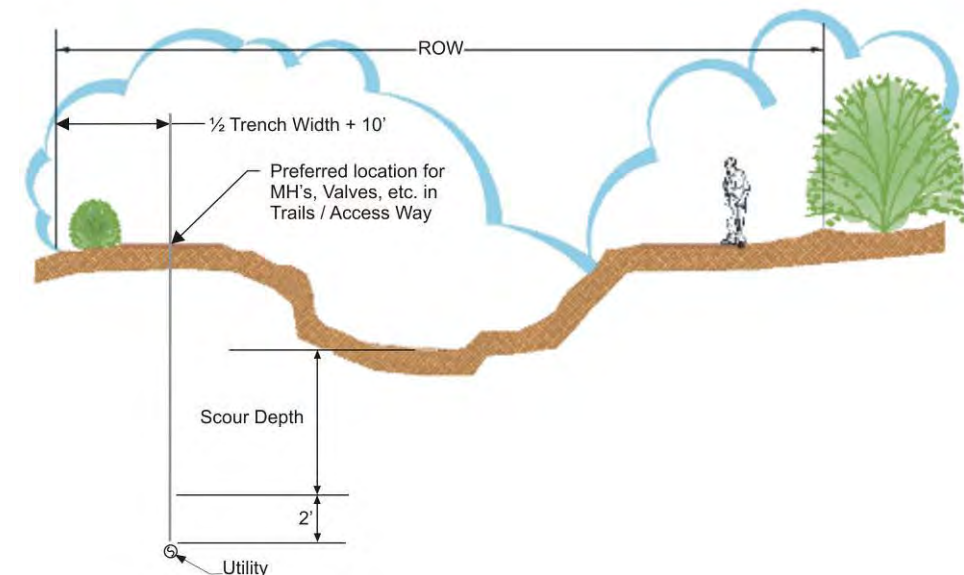
Assumptions  
Earthen channel velocity = 2 fps, Equilibrium slope = 0.1%, ROW @ \$30,000/acre See 2006 Technical Appendix for details.

**J. SEDIMENT CONTROL**

Until permanent stable conveyance facilities are constructed, sediment will continue to be generated from unstable arroyos, channels and other conveyances as well as from local runoff. Currently, much of this sediment is deposited at culvert inlets and at the outfall to the Rio Grande.

1. Sediment Transport in Facility Design. The major drainage facilities proposed in this WMP are intended to address future conditions when the watershed is essentially built out. As development occurs, the runoff becomes sediment starved requiring stabilization facilities to prevent significant erosion. Currently, and during the implementation period, the runoff sediment load varies from location to location as a function of the sediment supply and the sediment transport capacity of the conveyance. SSCAFCA standard sediment bulking rates are 6% for developed residential with paved streets and 18% for undeveloped properties and SFR developed antiquated platting with dirt streets. (See policy in Appendix 'B') The BAWMP recommends that facilities account for:
  - Sediment continuity including supply and transport through the system for existing and projected future conditions.
  - Potential current or future downstream impacts.
  - Local erosion protection, at point discharges, compatible with future arroyo treatments.
  - Potential sediment deposition in and across grade controls resulting in increased velocities and/or lateral migration.
  - Sediment deposition at narrowed cross sections and/or flattened grades, such as roadway culverts.

2. Rainwater Harvesting is an alternative runoff control measure to limit the volume and frequency of runoff events and thus reduce erosion. The concept is to capture and retain on-site the rainfall runoff from all or a portion of the property. The volume and frequency reduction can significantly reduce the cumulative erosion allowing more naturalistic conveyance options and if implemented throughout a drainage basin, can reduce LEE line width.



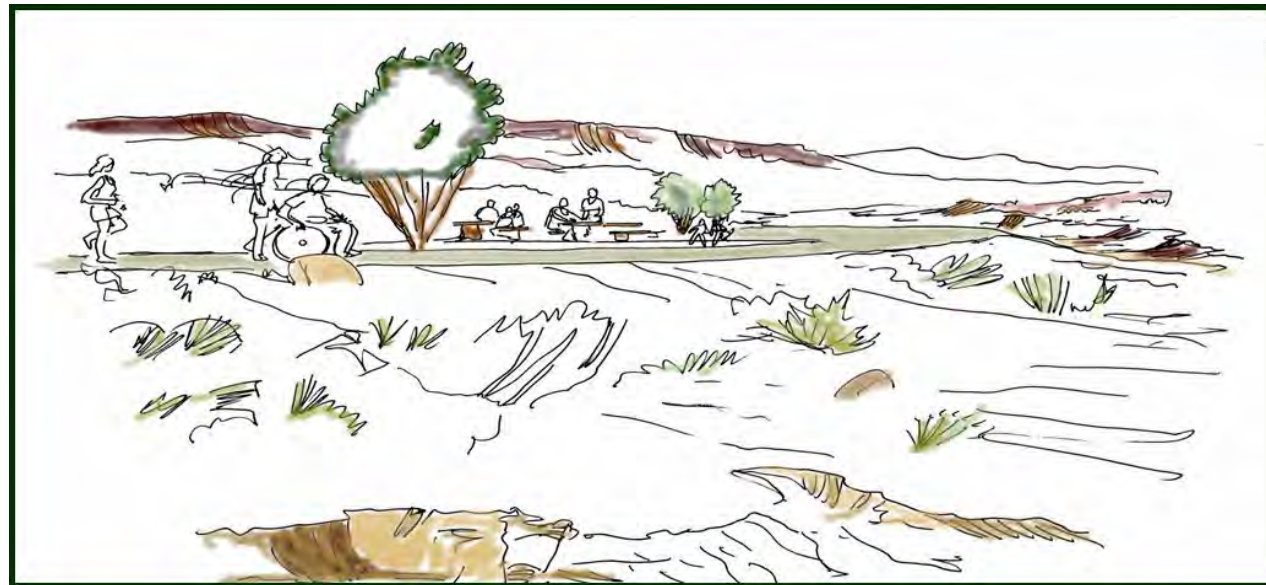
**EXHIBIT 4 - Typical Utility Location Section**



## K. UTILITIES

Utilities are a multiple-use of the drainage ROW not readily apparent to the public. Potential utilities include dry utilities such as communication and power and wet utilities such as water and sewer. An easement is required by SSCAFCA for placement of utilities within SSCAFCA ROW.

The City is constructing a sanitary sewer trunk line in the Barranca Arroyo Main Branch. Due to the potential for discharge of untreated sewage in the event of a line break or spill, sewer lines in the drainage ROW require special consideration. The utility criteria are contained in the SSCAFCA DPM (BARD 40).



**EXHIBIT 5 - WATERSHED PARK LINEAR CORRIDOR TRAIL CONCEPT**

## L. WATERSHED PARK and QUALITY OF LIFE PLAN

### 1. Quality of Life Planning Study

The Quality of Life Planning Study was conducted by Community Sciences Corporation concurrent with the 2006 BAWMP (BARD 14). The concepts developed in the Plan have been incorporated into the BAWMP. These include the Watershed Park concept, a linear parkway corridor with trail systems, open space, recreation, etc. utilizing SSCAFCA and public drainage right of way and local multi-use facilities utilizing detention basin ROW. Potential Watershed Park components are shown on Figure 6,

Watershed Park Components, in the Figures Appendix. Note that recreational facilities are not within SSCAFCA's authority and these facilities require funding and operations and maintenance by others.



Photo 15 - Burrowing Owls in Barranca Arroyo Vertical bank



WATERSHED PARK and QUALITY OF LIFE PLAN CONTINUED

2. Watershed Park Implementation in the DPM

Implementation of the Watershed Park is included in DPM Chapter 22, Section 9.C. This Section requires development that encroaches or is adjacent to a LEE line must consider inclusion of Quality of Life amenities and dedicate the LEE Line to SSCAFCA in fee simple.

3. Watershed Park Corridor

One Quality of Life vision is the concept of a linear parkway, the Watershed Park, along drainage ROW, including the Barranca Arroyo and appropriate tributaries. This parkway corridor would extend from the headwaters of the Barranca Arroyo to the Rio Grande with connections to other trail and path facilities, recreational facilities, education facilities and developments along the way.

The Watershed Park is incorporated in the BAWMP using the following concepts:

- For planning purposes, the parkway width is estimated to be the same as the naturalistic treatment width. It is recognized that this may be inadequate for park purposes in some areas and larger than needed in other areas and will need to be addressed during implementation.

- The Watershed Park is envisioned as an open space corridor with local multi-use facilities. Improvements could include a continuous trail system, trailheads, recreation areas, wildlife habitat and linkage corridors, educational and interpretive materials etc.
- The corridor width may be less than the LEE width and natural arroyo meanders and movements prior to eventual stabilization may not be contained within the corridor.

It is recommended that the Watershed Park concept be incorporated into drainage facility ROW planning and design. See the Quality of Life Planning Study, (BARD 14) for details.

The following sketch illustrates one Watershed Park Corridor concept:

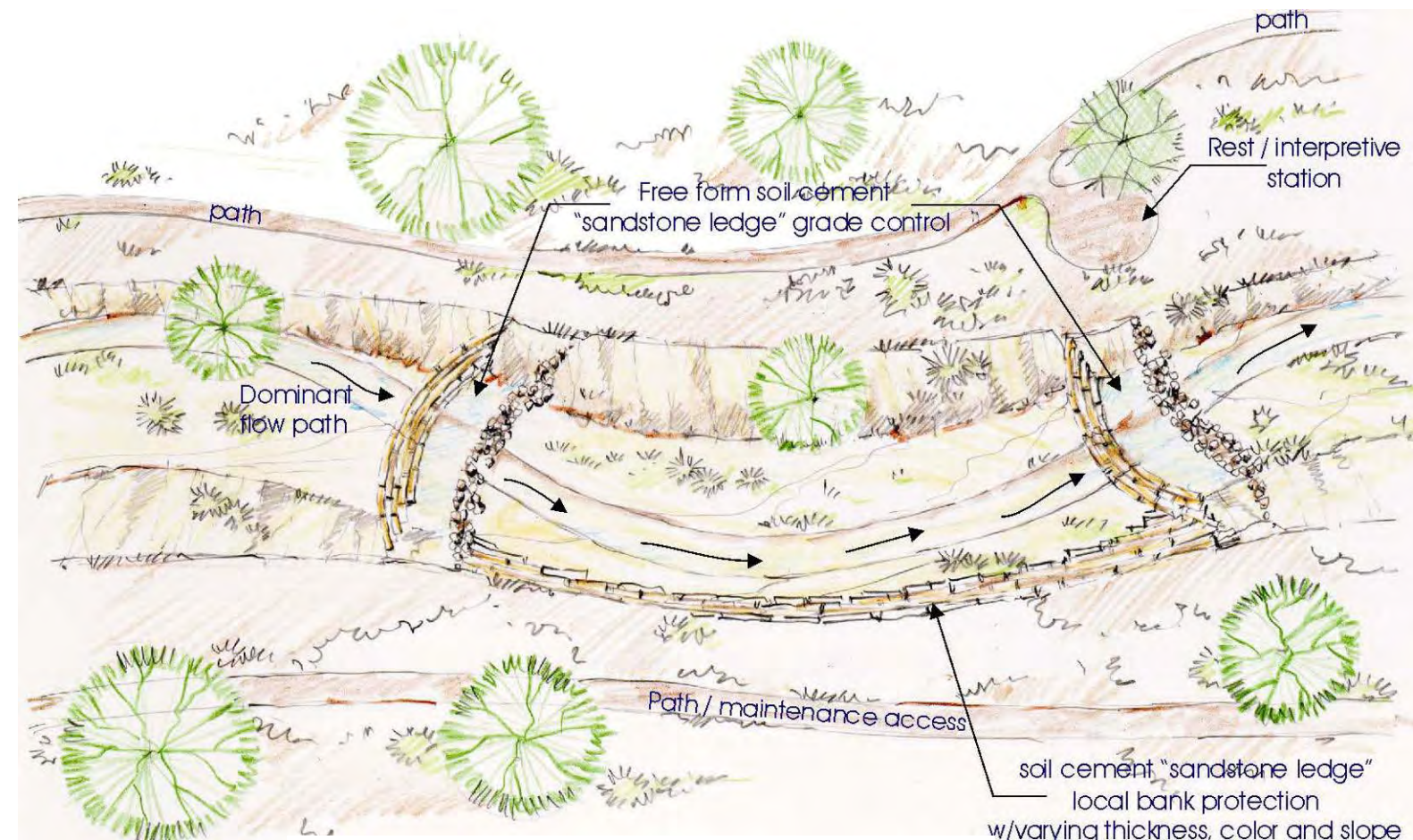


Exhibit 6 - Potential Watershed Park Corridor Alternatives



## M. ALTERNATIVE EVALUATION

### 1. Options Considered During Development of the 2006 BAWMP

Various options were considered to satisfy the design objectives and criteria. Eight options were investigated. Five options were determined to not be viable. Three options met the criteria and represented different concepts and approaches. These are:

- An “Initial Baseline” option based on initial field observations with 5 dams.
- A “Minimum Dam” option with 3 dams
- A “Maximum Naturalistic Conveyance” option with eight dams.

The options were presented for comment and approval to the Technical Team, Rio Rancho staff, the development community and at the public meeting. Maps and data for all of these options are in Appendix ‘E’ in the separately bound Technical Appendix.

#### a. Evaluation Considerations

The BAWMP is predicated on the “multiple detention concept”, the assumption that several smaller detention facilities in the upper portion of the watershed is preferred to one or two larger detention facilities lower in the watershed. The “multiple detention concept” offers the following advantages:

- Reduced overall cost.
- Increased safety due to lower flow rates in the arroyos.
- Distributed multiple use sites
- Distributed opportunities for water quality facilities
- Reduced ROW width due to reduced flow rates.
- Increased opportunity for naturalistic conveyance.
- Increased implementation flexibility and timing.

The “multiple detention concept” incorporates detention facilities which release at significantly lower flow rates than the historic flows in order to optimize the overall system. In some locations it is advantageous to release at 5 to 50 cfs to minimize downstream conveyance costs and/or maximize the length of storm drain or naturalistic conveyance. This essentially “cuts off” the upstream portion of the watershed. One example of this concept is the PdD Dam on the Main Branch (See Drainage Facilities Map 3)

#### b. Selected Option

The “Maximum Naturalistic Conveyance” (Option 8) was the preferred alternate based on input from SSCAFCA, the Rio Rancho staff, the development community and public meetings on April 4, 2006, and recommended by the technical team on April 13, 2006. This alternate was approved by the SSCAFCA Board of Directors on April 21, 2006.

Option 8 (shown on the following Exhibit 12) includes:

- Six Dams with multiple use potential
- 45% of conveyance is naturalistic
- 30% of conveyance is lined channels
- 25% of conveyance is in storm drains

### 2. Alternative Watershed Management

The 2006 BAWMP and Option 8, the proposed watershed management plan in BAWMPv2.0 presented above, utilize conventional drainage practices to provide flood protection and define the boundaries of erosion. This conventional storm water management focuses on flood control and treats runoff as a waste product to be conveyed via streets, storm drains, channels, dams, etc. to the Rio Grande as quickly as possible. Public infrastructure is required to safely convey the runoff and prevent erosion and flooding.

An alternative stormwater management program is being considered by SSCAFCA to supplement and/or replace conventional drainage management procedures in the SSCAFCA jurisdiction. The basic program concept is to keep the rainwater where it falls. It is identified as “rainwater harvesting” and is being investigated as this report is finalized.



Photo 16 Native Landscape Planting



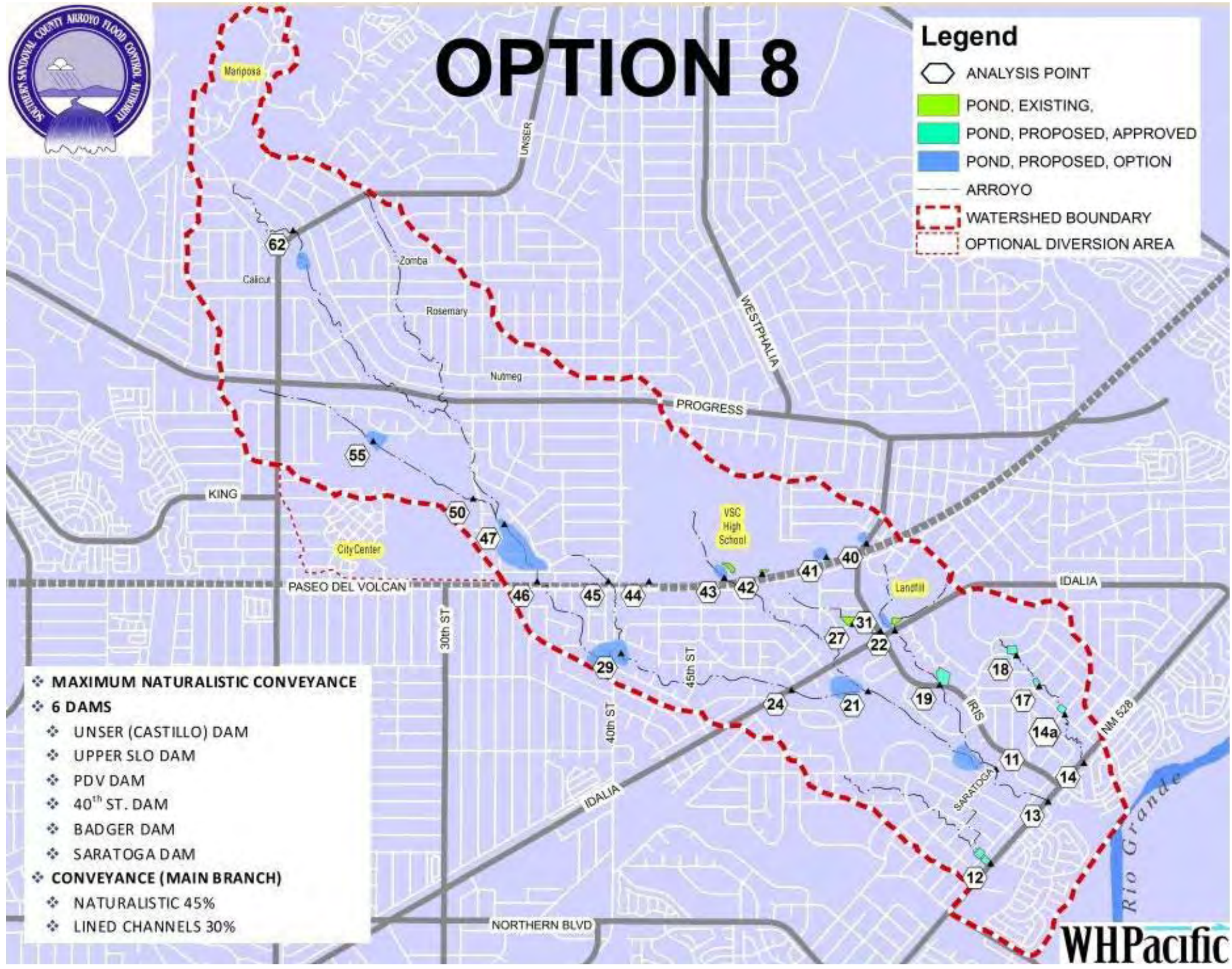


EXHIBIT 7 – Selected Watershed Management Option



**IV. BARRANCA ARROYO MANAGEMENT PLAN IMPLEMENTATION  
POLICIES, PROCEDURES, STANDARDS AND STRATEGIES**

The following policies, procedures and standards are recommended to implement the BAWMP v 2.0. Note that many of these recommendations apply to the entire SSCAFCA jurisdiction, not just the Barranca Arroyo watershed.

**A. EDUCATION AND COMMUNITY ADVOCACY**

Implementation requires broad community understanding and support. Education is considered to be the cornerstone of developing and expanding this support, including the willingness to invest in drainage and multiple-use infrastructure. A “Community Advocacy” program was identified in the SSCAFCA Venada Arroyo Multiple-Use & Education Plan (BARD 13) as one means of approaching this education. The Watershed Park concept is another way to promote the value of drainage infrastructure.

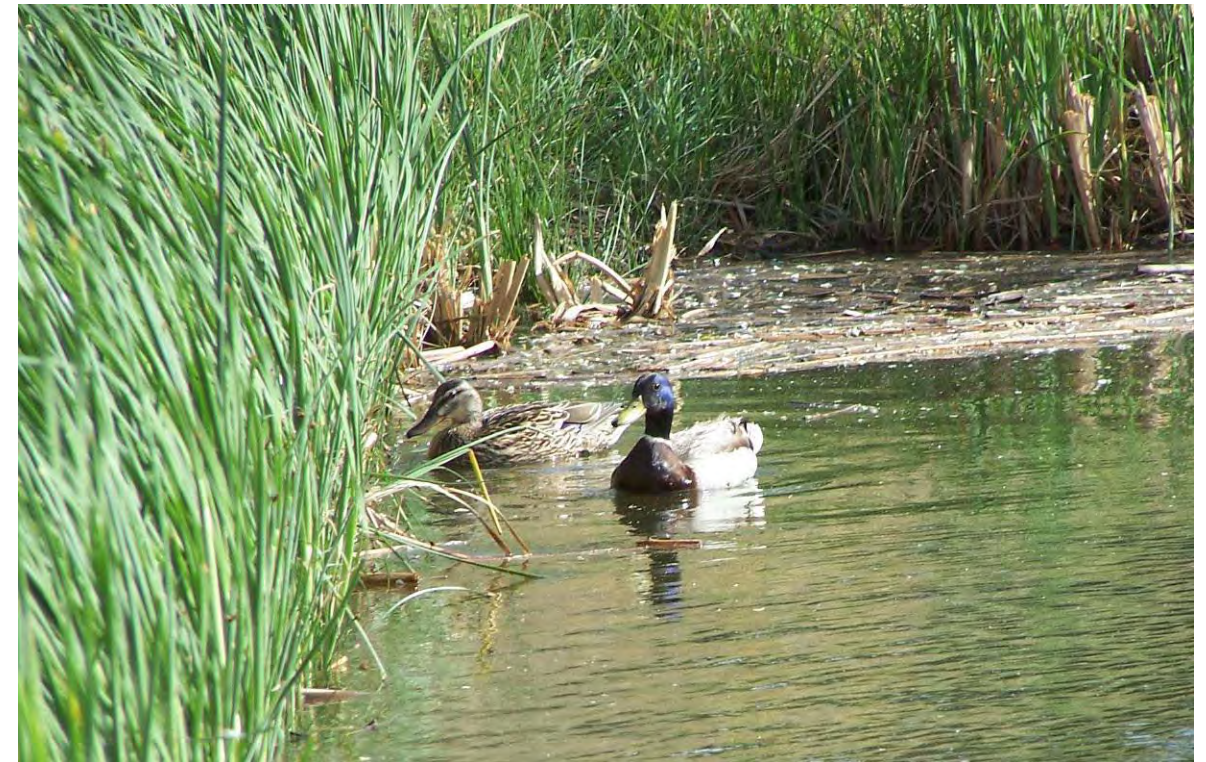


Photo 17 - Wildlife at Haynes Park Water Quality Pond



The intended result is a “Hydro Logic Cycle” resulting in a community willing to invest in drainage and associated multi-use facilities. The “Hydro Logic Cycle” components include:

- Ensure that all drainage facilities provide demonstrative community value.
- Increase community enjoyment and observed benefit by development and promotion of multiple-use facilities.
- Educate and inform the public of the SSCAFCA mission and the community value of flood control, storm water quality, multiple uses, etc.
- Maintain safety education programs.
- Develop grass roots support through community activities and public exposure.

**EXHIBIT 8 - HYDRO LOGIC CYCLE**



## B. FUNDING

The data developed in the BAWMP provides a basis for evaluating funding needs and overall priorities. Funding sources, in addition to bond funds, should be identified and developed to assist in implementing the BAWMP. All funding efforts should be in conjunction with communities within the SSCAFCA jurisdiction.

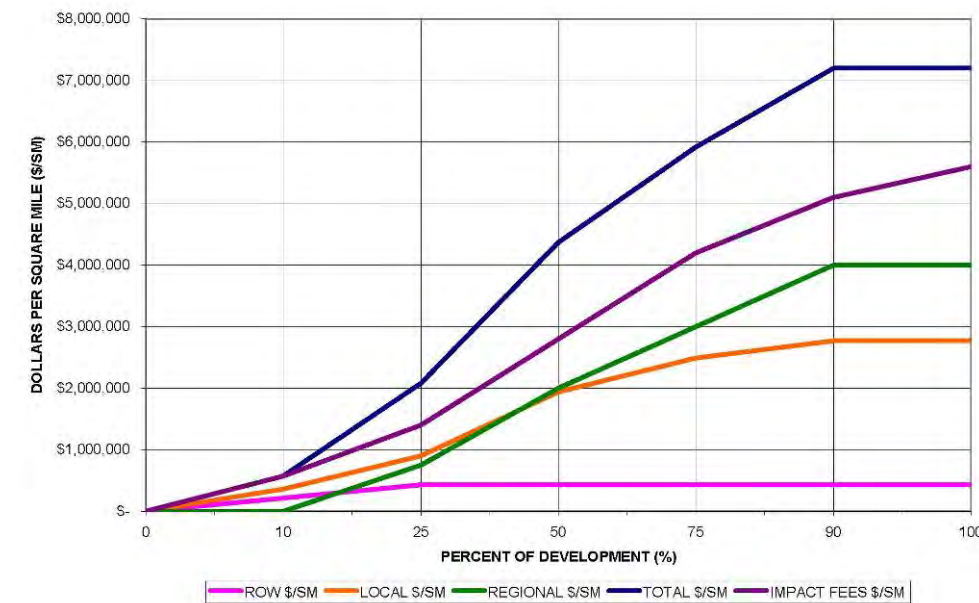
### 1. Potential funding sources include:

- **Impact Fees.**  
A large portion of the undeveloped area within the Barranca Arroyo Watershed is platted with individual ownership and single family residential (SFR) development. Rio Rancho has implemented drainage impact fees for SFR development to partially fund drainage infrastructure. Coordination between Rio Rancho and SSCAFCA for local facility and regional facility capital budgets and priorities is recommended to optimize the community value of this revenue source.
- **Public/Private Cost Sharing**  
Cost sharing with subdivision and other development within the watershed presents an opportunity for increased community value and should continue to be pursued. A cost sharing concept based on benefits was developed as part of the
- **Developer Funded and Constructed**  
New subdivisions, commercial and industrial developments should fund the drainage and water quality improvements required due to the development.
- **Obligation Bond Financing**
- **Federal, State, Agency Grants and Loans**
- **User/Utility Fees**
- **Local Special Assessment Districts**
- **General Funds of communities within the SSCAFCA jurisdiction.**
- **Inspection and Permit Fees**

### 2. Funding Requirements as a Function of Development.

- **Background**  
Due to the development history and growth rate in the SSCAFCA jurisdiction, the need for drainage infrastructure exceeds the funds available. This is an issue throughout the jurisdiction, not just within the Barranca Arroyo Watershed. Future SFR development in antiquated platted areas will pay a drainage impact fee to help cover a portion of the cost associated with the increased runoff from the development. However, the impact fees are collected at the time of development of each lot and adequate capital is not available to construct the needed infrastructure prior to development.
- **Infrastructure Need**  
The drainage infrastructure need as a function of development depends on many variables such as capacity of existing facilities, topography, risk, etc. These will be different for each drainage basin or facility. Note that new subdivisions provide drainage infrastructure for the subdivision development and these facilities are required to keep pace with drainage requirements.

- **Development Funding**  
A rough estimate of the relationship between percent SFR development and needed drainage facilities was developed based on observations and anecdotal information from different SFR areas within Rio Rancho. Based on data from the Rio Rancho Drainage Impact Fees Status Report, February 2005, SFR drainage infrastructure cost is \$5,600/du (\$11,200/ac.) and Drainage Impact Fees are \$4,465/du. An estimate of the SFR development to infrastructure cost relationship is illustrated on the following graph.



**EXHIBIT 9 - SFR DEVELOPMENT FUNDING**

## C. ARROYO SAFETY EDUCATION PROGRAMS

Promotion of arroyo safety is an on-going and continuous campaign by all local jurisdictions and agencies to increase and maintain awareness of the inherent dangers in arroyos, channels, ditches, etc. Due to the extent and magnitude of the local arroyo, channel, ditch and canal system; non-structural educational programs are recommended.

The BAWMP recommends continuing on-going targeted education programs to inform all citizens, especially children and parents, of the risks associated with the natural arroyos and other conveyances. This education should be tied to the Quality of Life Watershed Park as both a design and educational component.





Photo 18 – David Stoliker and Clint Dodge at Vertical Bank west of Saratoga Road (25'+/-)

#### D. LATERAL EROSION ENVELOPE & PROPERTY-AT-RISK

- SSCAFCA, in conjunction with local government agencies, develop and implement policies and procedures for properties-at-risk.
- Use the Lateral Erosion Envelope (LEE) to define property-at-risk due to the lateral migration of natural arroyos.
- Inform property owners of the increased risk.
- Implement a process, as an option, for the property owner to control the LEE line and reduce the impact to the property-at-risk.

#### E. FACILITY PLANS

- Develop consistent guidelines and criteria for Facility Plans.
- Develop Facility Plans for platted SFR areas within the watershed where the flow paths are poorly defined.
- Develop Facility Plans for each new major drainage facility.
- In the Facility Plans, address interim and ultimate detailed hydrology, hydraulics, sediment continuity, water quality and environmental impacts.



Photo 19 - Main Branch south of Progress Rd.

#### F. LOCAL PONDS

- Local ponds are small ponds developed in conjunction with small re-platting, local development, etc. to control runoff from small drainage areas.
- Conform the design to the requirements of the DPM (BARD 40).

#### G. POINT DISCHARGES

- Evaluate the need for a policy requiring a Facility Plan for each major point discharge
- Address local erosion and damage due to the introduction of higher velocity flows and clear water point discharges.



#### H. NATURALISTIC CONVEYANCE

- Provide stable non-erosive conveyance with the aesthetic characteristics of natural arroyos.
- Utilize naturalistic treatment for arroyos, channels and other constructed surface conveyance except where infeasible.

#### I. HYDROLOGY-OF-RECORD

- Utilize the hydrology developed in the BAWMP as the basis of evaluation of future facilities, development plans, modifications, etc.
- To ensure public health, safety and welfare, SSCAFCA will develop and maintain the adopted "Master" regional HEC-HMS hydrology for all watersheds within its jurisdiction. Updates and revisions will be made and tracked by SSCAFCA or its designee.
- A copy of the "Master" HEC-HMS model will be available for reference by others. See the SSCAFCA website for the HEC-HMS model status and the process to obtain copies of the model. Use of electronic media provided by SSCAFCA is solely at the user's risk.



Photo 20 - Fence in arroyo

#### J. STORM WATER QUALITY TREATMENT

- Incorporate stormwater quality treatment in accordance with the DPM (BARD #40) (currently a 0.6" 6-hour storm event). All development is required to address water quality.
- Require commercial and industrial developments to construct, operate and maintain on-site water quality facilities.

#### K. OWNERSHIP

- Develop a comprehensive property rights policy, limit, etc.
- Obtain public ownership for all major drainage facilities.
- Obtain a public drainage easement with right of access for inspection and maintenance for local facilities integral to the operation of the system, which are not in public ownership (such as local detention ponds and local water quality enhancement facilities).
- Due to arroyo meander and mapping inaccuracies, the FEMA mapped floodplain, the existing public property and the physical location of the arroyo frequently do not coincide.
- The LEE line in the BAWMP is based on the physical arroyo location and should be used to implement the LEE properties-at-risk policy (i.e. not the public owned property lines).
- Develop and implement policies to provide public property interest, such as easements, ownership or equivalent of areas within the 100-year floodplain and/or the LEE line. This is intended to ensure that the arroyo system can convey the design flood.
- Re-evaluate the location and extent of the floodplain, and where appropriate, the floodway and update the floodplain mapping to incorporate revised arroyo locations and current topography.

#### L. QUALITY OF LIFE/WATERSHED PARK

- Develop and implement standards to safely combine drainage ROW and Watershed Park facilities.
- Promote joint public/private and interagency development of Watershed Park components.
- Implement the proposed BAWMP Watershed Park facilities including:
  - Headwater to Rio Grande Parkway trail systems,
  - Wildlife corridors,
  - Habitat protection,
  - Open space,
  - Education connectivity,
  - Recreation,
- Incorporate other appropriate elements defined in the Quality of Life Planning Study (BARD 14).



**V. BARRANCA WATERSHED PARK MANAGEMENT PLAN IMPLEMENTATION FACILITIES**

**A. FACILITY SUMMARY**

The proposed facilities recommended in the BAWMP are based on Option 8 as discussed in Section III. Details of the existing and proposed facilities are shown on the Drainage Facilities Maps 1 through 8 in Figures Appendix. Technical data is presented in the Facility Data Tables opposite each Facility Map.

Note that each facility is assigned a unique identifier based on the location and type of facility. These facility identifiers are listed on the Drainage Facilities Maps and on the corresponding Facility Data Tables. The facility identifier is an abbreviated version of the unique identification system in the SSCAFCA Geographical Information System (GIS). (Copy included on compact disk)

**B. FINANCIAL SUMMARY**

The Facility Data Tables include budget estimates for the proposed facilities. The total estimated construction costs associated with the facilities to provide storm water runoff protection for ultimate development conditions is approximately \$50,700,000. ROW acquisition is estimated to be an additional \$11,100,000. Note that these are total estimates, regardless of potential funding sources. Also, these budget estimates are based on “rule-of-thumb” guidelines and are not based on site specific or project specific analyses (See the Technical Appendix for details).

**TABLE V-1  
BUDGET SUMMARY**

ITEM	BUDGET ESTIMATE
ROW for Flood Control/SWQ Dams	\$5.3M
Construction of Flood Control/SWQ Dams	\$24.2M
ROW For Conveyances	\$5.8M
Construction of Conveyances	\$26.5M
TOTAL	\$61.8M

**C. IMPLEMENTATION**

Implementation and funding of the BAWMP will compete with other drainage needs, as well as other public programs, and is expected to take decades to complete. The following components are recommended to address a prolonged implementation period (Section references are in parentheses):

1. Education and Community Advocacy
  - Build public support for multiple use drainage facilities with the “Hydro Logic Cycle” (IV.A).
  - Implement the Watershed Park concept. Incorporate innovative components such as “Land Art” (III.M & IV.L).
  - Maintain Public Safety Education and Awareness Programs (IV.C).
2. Watershed Management.
  - Implement rainwater harvesting as an alternative or supplement to conventional drainage control concepts.
  - Implement development, evaluation and ROW criteria (III.E & IV).
  - Implement the watershed management concepts in Option 8 (III.N).
  - Maintain implementation flexibility with alternate sites, concepts, etc. (V.B)
  - Incorporate environmental considerations in plans and designs (II.C).



**EXHIBIT 10– Trail and natural arroyo concept**





Photo 21 – Information signage at Haynes Park Water Quality Facility

3. Funding, Budgets and Priorities.

- Maintain procedures and coordination of Capital Improvement Project (CIP) budgets and priorities with Rio Rancho (IV.B).
- Optimize investment of drainage impact fees (IV.B).
- Pursue other funding sources, including public/private partnerships, for the proposed improvements (IV.B).

4. Property and ROW.

- On-going review of policies for property rights requirements, limits and standards (III.E & IV.K).
- Explore alternative forms of property rights, such as conservation easements, development rights transfers, etc. (III.E)
- Maintain a ROW Action Plan for conveyance ROW and for proposed facilities (III.E).
- Integrate Watershed Park elements such as trails, open space, wildlife habitat, etc. into new developments, ROW considerations and facility designs. (III.M).
- Identify and obtain property rights for reaches with naturalistic conveyance (III.E).
- Incorporate floodplain and FEMA controls into property rights and ROW standards (III.E).
- Obtain property rights for arroyos across antiquated platted lots (III.E).

5. Lateral Erosion Envelope (LEE).

- Investigate appropriate upstream limit for LEE implementation (III.I)

6. Facility Plans.

- Develop and implement Facility Plan criteria and standards (IV.E).
- Perform supplemental investigations (such as Facility Plans) where more detailed data is required to implement the BAWMPv2.0 (IV.E).
- Some specific areas recommended for Facility Plans are identified in the BAWMP on the Drainage Facilities Maps in Figures Appendix.

7. Design

- Implement the criteria identified in the BAWMP (III.C).
- Utilize the BAWMP hydrology as the basis for designs and evaluations (III.D).
- Develop design standards and requirements for naturalistic conveyance (III.J & IV.H).
- Utilize naturalistic conveyance treatment concepts and channel treatments except where infeasible (III.J).
- Incorporate sediment control considerations (III.K).
- Implement criteria for utility uses in SSCAFCA ROW (III.L).
- Develop point discharge standards and requirements (IV.G).
- Require local ponds to meet BLWMP standards (IV F)

8. Storm Water Quality

- Continue public education and pollutant runoff control measures.
- Review and upgrade storm water quality standards (IV.J).
- Require commercial and industrial developments to construct, operate and maintain water quality facilities (III.H).
- Incorporate storm water quality treatment in all drainage facilities (III.H).
  - Include reduction of gross pollutants and floatables.
  - Address bacteria and fecal coliform controls.



EXHIBIT 11 – Watershed Park Concept



# Flood Control

Non-erosive earthen engineered channels and arroyos with native vegetation minimize visual "man-made" impact and provide shallow low-velocity flow.

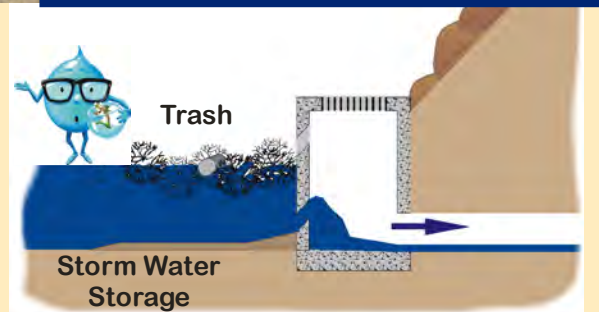
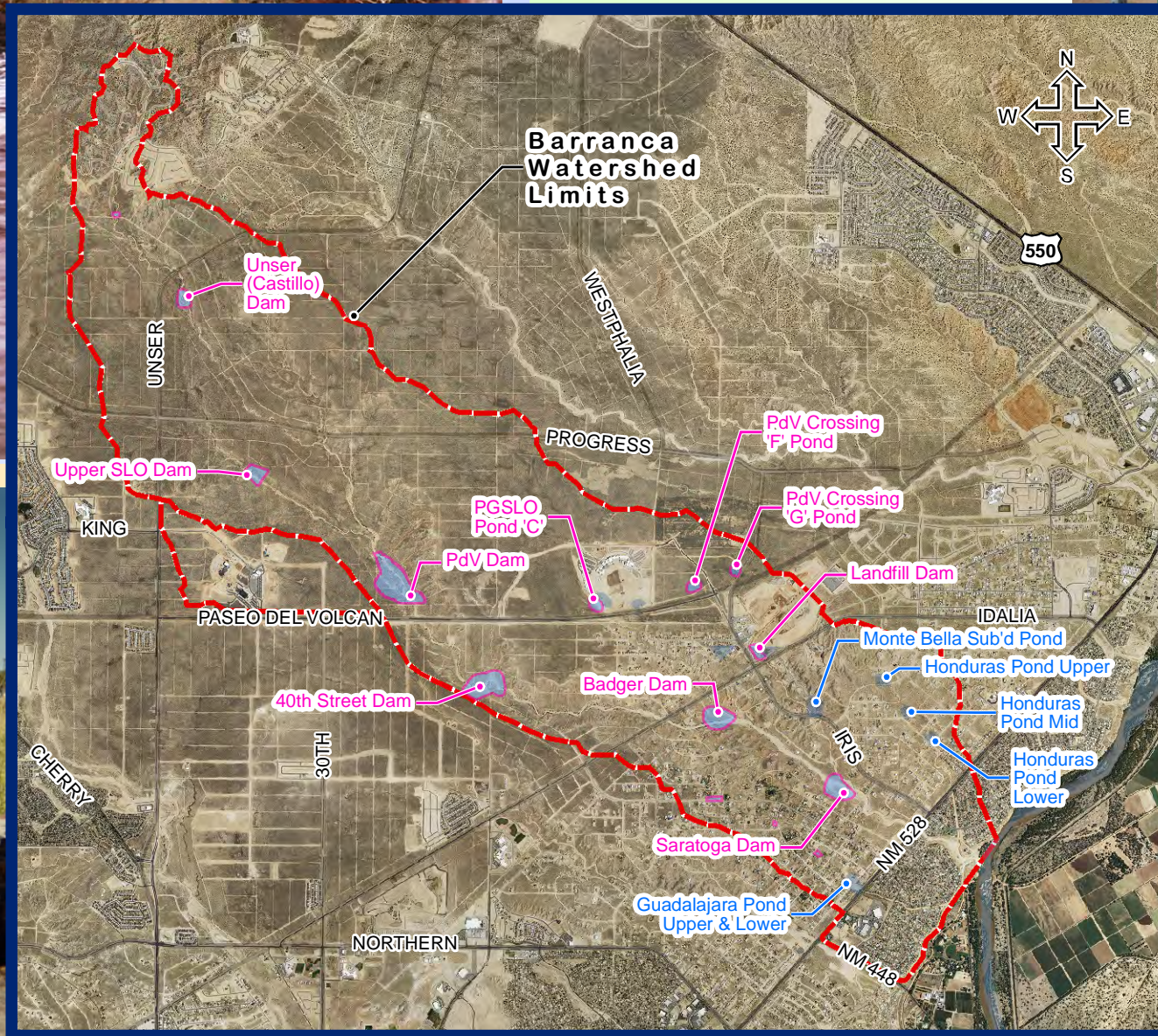


"Man-made" water quality and debris removal facilities reduce stormwater pollutants reaching the Rio Grande.

# Water Quality Protection



The "Watershed Park" vision is an interconnected linear park system promoting quality of life amenities using flood control right of way to maximize community value. This includes trails, linear parkways, wildlife habitat, recreation, native plantings, property value enhancement, water conservation, open spaces, etc.

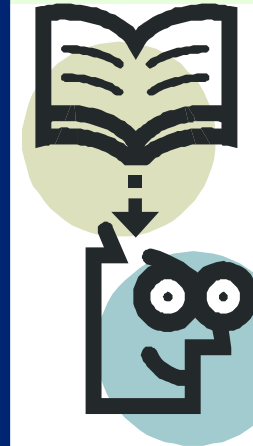


STORM WATER POLLUTION CONTROL

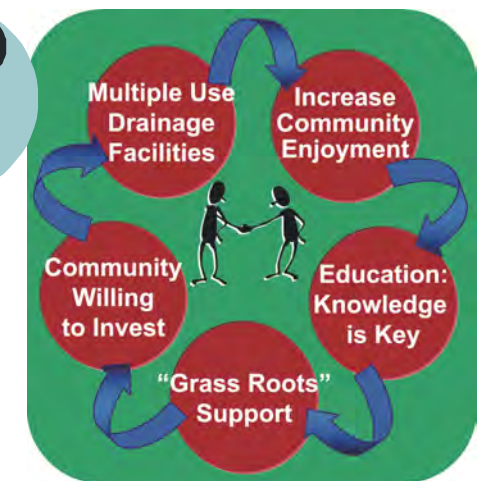
*Flood Control Today... For a Safe Tomorrow...*

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# Quality of Life 'Watershed Park'



Flood protection, cleaner storm water runoff and public uses are interconnected. All provide benefits to the community.



Community Advocacy utilizes education and cost effective drainage facilities with multiple uses to add community value and build public support for SSCAFCA's mission - public health, safety and welfare.

# Community Advocacy