

FINAL

Volume III
Appendices

JANUARY 2010

SOUTHEASTERN LINCOLN COUNTY

HABITAT CONSERVATION PLAN

SOUTHEASTERN LINCOLN COUNTY

Appendices

VOLUME III

FINAL

JANUARY 2010



prepared by



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prepared for



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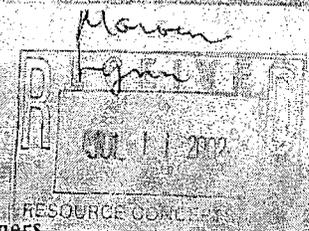
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Lincoln County Commission Resolution
(2000–2006)

RESOLUTION NO. 2000-06



**A Resolution of the Board of Lincoln County Commissioners
Authorizing Preparation of the Lincoln County Multi-Species Habitat Conservation Plan
and Related Environmental Assessment and Section 10 Permit Application to the
United States Fish and Wildlife Service**

WHEREAS, failure of Lincoln County to develop a multi-species habitat conservation plan and to obtain a Section 10 Permit from the U.S. Fish and Wildlife Service will constrain diversification and expansion of the Lincoln County economy and will prevent development and use of private lands in the County, and

WHEREAS, preparation of a multi-species HCP and related environmental assessment, similar to that developed by Clark County will significantly reduce uncertainty regarding future U.S. Fish and Wildlife actions to list species as threatened and endangered, and

WHEREAS, initiation of work on the Lincoln County HCP should include one or more workshops in the County to explain the need for preparation of and the process of completing the HCP, and

WHEREAS, a technical steering committee should be organized to oversee County preparation of the HCP to include representation from Lincoln County and City of Caliente government; affected land owners; outdoor recreation enthusiasts; developers; business and industry; the building trades; NDOW; NDOT; USFWS and BLM and others as appropriate, and

WHEREAS, to the extent practical, non-agency membership to the technical steering committee should be limited to residents of Lincoln County, and

WHEREAS, a single multi-species HCP should be developed for all of Lincoln County, with preparation of the plan done in phases by specific planning area in order to facilitate timely funding and completion, and

WHEREAS, the development and approval of a multi-species habitat conservation plan and subsequent issuance of a Section 10 Permit to Lincoln County will allow development to occur in private land within Lincoln County, and

WHEREAS, such development will significantly increase the tax base in Lincoln County which will allow Lincoln County to provide necessary services to its residents and may provide sufficient revenue to allow Lincoln County to financially support existing or new legislative and/or legal initiatives important to its residents, and

WHEREAS, the first phase of the Lincoln County Multi-Species Habitat Conservation Plan should cover all private lands and all federal lands transferred to private ownership during the term of the permit located within the area lying east of Range 62/Range 63 East range line to the Utah state line and south of the Township 3/Township 4 South township line to the Clark County

line plus that portion of the Coyote Springs Investment leasehold extending into Clark County, and

WHEREAS, the initial budget for preparation of the HCP should be set at One Hundred Thirty Thousand Dollars (\$130,000.00). If possible, costs for the plan will be derived from mitigation fees paid by developers of utility corridors (i.e. fiber optics) and/or NDOT to U.S. Fish and Wildlife Service for projects in Lincoln County. If such monies are not available, funding will be obtained from affected private land owners and developers to be reimbursed from mitigation fees collected through implementation of the HCP. Any balance of funding needed will be sought through a loan from the Clark County Habitat Conservation Plan Mitigation Fund with repayment to result from mitigation fees collected through implementation of the Lincoln County HCP.

NOW THEREFORE BE IT RESOLVED, that the Board of Lincoln County Commissioners does hereby authorize the preparation of the Lincoln County Multi-Species Habitat Conservation Plan and related environmental assessment and 30-Year Section 10 Permit Application to the United States Fish and Wildlife Service. The initial scope of the HCP shall include current and potential private, County, and City of Caliente lands within the area lying east of Range 62/Range 63 East range line to the Utah state line and south of the Township 3/Township 4 South township line to the Clark County line plus that portion of the Coyote Springs Investment leasehold extending into Clark County.

BE IT FURTHER RESOLVED, that the Board of Lincoln County Commissioners does hereby designate the Lincoln County Regional Development Authority with interim responsibility to initiate the habitat conservation planning process, including securing necessary funding; coordination with state and federal agencies; preparation of an HCP Development implementation strategy and schedule; and organization of a technical steering committee to oversee the HCP process.

BE IT FURTHER RESOLVED, that the Board of Lincoln County Commissioners does hereby authorize the formation of the Lincoln County HCP Technical Steering Committee to be comprised of the following members: one member of the Lincoln County Commission; one member of the Caliente City Council; one person appointed by the Lincoln County Public Lands Commission; one person appointed by the Lincoln County Farm Bureau; one person appointed by the Lincoln County Regional Development Authority; one person appointed by the Lincoln County Commission to represent large developers with interests in southeastern Lincoln County; one person appointed by the Lincoln County Commission to represent small landowners; one person appointed by the Lincoln County Commission to represent mining interests; one person appointed by the Lincoln County Commission to represent off-highway vehicle enthusiasts; one person appointed by the Lincoln County Commission to represent sportsmen; one representative of the United States Fish and Wildlife Service; one representative of the Resource Management Steering Committee; one representative of the Bureau of Land Management; one representative of the Nevada Division of Wildlife; and one representative of the Nevada Department of Transportation.

BE IT FURTHER RESOLVED, that the Board of Lincoln County Commissioners will be provided a monthly status report on the development of the HCP.

BE IT FURTHER RESOLVED, that the Board of Lincoln County Commissioners may suspend work on the HCP at any time if it is determined by the Board to be in the best interest of the County to do so.

CONSIDERED AND ADOPTED this 20th day of April, 2000 by the Board of Lincoln County Commissioners.

Voting Aye:

Paul Christensen
Shawn Wickens
Jim Perkins
Dan Frehner

Voting Nay:

Abstaining:

Paul Donohue

Board of Lincoln County Commissioners

Dan Frehner

Dan Frehner, Chairman

Attest:

Cornie Hogan
Cornie Hogan, Lincoln County Clerk

APPENDIX B

Development Agreement

**PARCEL A
AGREEMENT TO DEVELOP
BETWEEN
LINCOLN COUNTY, NEVADA
AND**

THIS Agreement to Develop (AGREEMENT) is made and entered into this _____ day of _____, 2001, by and between Lincoln County, State of Nevada (hereinafter referred to as the (COUNTY), and _____, (hereinafter referred to as the Master Developer (DEVELOPER). Capitalized terms used herein shall have the meanings ascribed to them in this AGREEMENT.

WHEREAS:

There is located within the boundaries of the COUNTY 4,357.77+/- acres of undeveloped public land administered by the United States Department of the Interior, Bureau of Land Management (BLM); and

The BLM intends to sell the 4,357.77+/- acres (PROPERTY) at Auction on or before the Auction Date pursuant to the Lincoln County Land Act of 2000 (LCLA), P.L.106-298 and all other applicable Federal and State legislation; and

On _____, the COUNTY, the BLM, and the City of Mesquite, Nevada entered into a Memorandum of Understanding (MOU) to facilitate the orderly disposal of the PROPERTY pursuant to the LCLA in a manner that will provide a fair return to the United States while allowing the COUNTY to plan for its future growth and development within the boundaries of the PROPERTY; and to assure the City that said development will be compatible to and consistent with existing and proposed development within the City; and

The COUNTY and BLM have agreed that the PROPERTY should be marketed and sold consistent with the desires of the COUNTY which include development of the PROPERTY under a single master plan, incorporating mixed-uses, including residential, commercial, industrial, and public uses, known as a Master Planned Community. The COUNTY and the BLM agree that the PROPERTY is not to be sold in a manner that would encourage speculation and/or sold off in smaller lots for ad hoc development.

The COUNTY and BLM have agreed that requiring the successful bidder to enter into an AGREEMENT is the best method to assure that the goals and objectives of the COUNTY and the United States, as expressed in the MOU, will be carried out. The property will be sold consistent with the Notice of Realty Action (NORA) as published in the Federal Register on _____, 2001.

The highest bidder at the Auction will enter into this AGREEMENT and an associated Conveyance Agreement with the COUNTY within thirty (30) days of the Auction Date. If the highest bidder fails to do so, the next highest bidder will be offered the PROPERTY provided the next highest bidder enters into the Agreements with the COUNTY within thirty (30) days of being declared the apparent high bidder. The successful bidder will enter into a more formal Development Agreement as authorized under NRS Chapter 278 (DEVELOPMENT AGREEMENT) with the COUNTY prior to developing the property; and

The DEVELOPMENT AGREEMENT will contain, as a significant part thereof, Covenants, Conditions and Restrictions (CC&Rs) to run with the land and zoning codes and regulations agreed to between COUNTY and DEVELOPER.

This AGREEMENT is intended to provide for the orderly disposal and development of the PROPERTY in accordance with the intent of the MOU, the NORA, and COUNTY land use policy and ordinances, by setting forth the parameters under which the parties will enter into a formal DEVELOPMENT AGREEMENT as that term is used in NRS Sections 278.0201 through 278.0207 inclusive, and

It is understood by the parties hereto that future ordinances will be enacted by the Board of Lincoln County Commissioners governing the development of lands located in Lincoln County which ordinances shall be substantially similar to the current provisions of the existing development code utilized by the City of Mesquite, Nevada requiring the provision of public services, public facilities and urban infrastructure by DEVELOPER, to promote the health, safety and general welfare of the COUNTY and its inhabitants.

DEVELOPER wishes to obtain reasonable assurances that DEVELOPER and COUNTY agree in concept with DEVELOPER's proposed development of the PROPERTY in order to incur the costs necessary to enter into the DEVELOPMENT AGREEMENT. DEVELOPER acknowledges that there are inadequate public services, public facilities, urban infrastructure and services existing at this time, therefore, the DEVELOPER will need to provide certain public services, public facilities and urban infrastructure in order to make the PROPERTY conducive to residential, commercial and industrial development.

NOW, THEREFORE, it is agreed as follows:

SECTION 1. DEFINITIONS

For all purposes of this AGREEMENT, except as otherwise expressly provided or unless the context otherwise requires, the following terms shall have the following meanings:

"Agreement" has the meaning assigned to it in the first paragraph hereof. AGREEMENT at any given time includes all addenda and exhibits incorporated by reference and all amendments, which have become effective as of such time.

"Auction" means the public sale of the PROPERTY by the BLM on the Auction Date and at the location as designated by the BLM.

"Auction Date" means the 12th day of October, 2001, or such other date as determined by BLM for holding the Auction.

"BLM" means the United States of America, by and through the Department of the Interior, Bureau of Land Management.

"Auction Rules" means all laws, rules and regulations applicable to auctions conducted by the BLM including all auction sale procedures adopted by or applicable to the BLM.

"City" means the City of Mesquite, Nevada.

"Code" means the City of Mesquite Development Code as adopted by Lincoln County and applicable to the PROPERTY.

"COUNTY" means Lincoln County, Nevada.

"County Ordinance and/or Code" means the Lincoln County Ordinance and/or Code, including all rules, regulations, standards, criteria, manuals and other references adopted herein.

"County Commission" means the Lincoln County Board of Commissioners.

"DEVELOPER" has the meaning assigned to it in the first paragraph hereof and its permitted successors and assigns.

"DEVELOPMENT AGREEMENT" means an agreement to develop in accordance with the provisions of NRS Sections 278.0201 through 278.0207 inclusive.

"Development Plan" means the plan of development of the DEVELOPER for the PROPERTY. The Development Plan shall include not less than all of the provisions of this AGREEMENT, such additional matters as required or permitted under this AGREEMENT, and the DEVELOPER's plan for the Public Use Acreage.

"Effective Date" has the meaning given to it in Section 2.01.1 of this AGREEMENT.

"MOU" means the Memorandum of Understanding entered into between the COUNTY, City and BLM dated

"NRS" means Nevada Revised Statutes.

"Patent" means the document by which, upon execution by, and delivery by, the United States to DEVELOPER, DEVELOPER will become the holder of title, and upon recording with the Lincoln County Recorder of Deeds, the record holder of title, to the PROPERTY.

"PROPERTY" means the public lands acreage administered by BLM in the COUNTY and to be sold by the BLM at the Auction. The PROPERTY shall comprise 4,363+/- acres, which includes the Public Use Acreage.

"Public Use Acreage" means those portions of the PROPERTY intended for use for roadways, drainage facilities and other public purposes and to be transferred to the COUNTY and/or Lincoln County School District after the Auction Date.

"Term" means the term of this AGREEMENT together with any extension hereof.

SECTION 2.

THE AUCTION and THE INTENT OF THIS AGREEMENT

2.01 Sale at Auction. The PROPERTY was offered for sale by the BLM at the Auction on the Auction Date, and DEVELOPER was the successful bidder. The Auction was conducted lawfully and in furtherance of the terms and provisions of the LCLA and the terms, provisions and intentions of the MOU and the NORA.

2.02 Requirement for this Agreement. Pursuant to the MOU, the NORA, and the LCLA, DEVELOPER and COUNTY must enter into this AGREEMENT, and this AGREEMENT is a condition precedent to the BLM's conveyance of the PROPERTY to DEVELOPER.

2.03 Purpose of this Agreement. The MOU and the LCLA contemplate development of the PROPERTY as a Master Planned Community. It is intended by the parties that this AGREEMENT will outline the basic intent of the DEVELOPER for development of the PROPERTY into a Master Planned Community contemplated by DEVELOPER for the PROPERTY, demonstrate the concept which DEVELOPER has for the Master Planned Community, and generally set forth the structure of the DEVELOPMENT AGREEMENT to be entered into between the parties and such other matters as may be determined necessary to provide for the proper development of the PROPERTY. Furthermore, pursuant to the Conveyance Agreement, the DEVELOPER is

required to convey to the COUNTY and the Lincoln County School District, in fee simple absolute, and without cost to COUNTY or the School District, the Public Use Acreage to be utilized for public benefit, whether through roadway, drainage, recreational use, schools or public facilities. This AGREEMENT, among other things, outlines the procedures for compliance with the Conveyance Agreement.

2.04 County Authorization. The County Commission shall consider this AGREEMENT at a public hearing. Approval and execution of this AGREEMENT by COUNTY shall not grant DEVELOPER any development rights in or for the PROPERTY, nor create any rights to which a landowner might be entitled by virtue of a DEVELOPMENT AGREEMENT under NRS Sections 278.0201 through 278.0207 inclusive. DEVELOPER shall be required to enter into the DEVELOPMENT AGREEMENT with COUNTY prior to any development of the PROPERTY.

SECTION 3. MASTER PLANNED COMMUNITY CONCEPT

3.01 Conceptual Land Use Map. Attached hereto as **Exhibit "A"** is DEVELOPER's conceptual land use map identifying in general DEVELOPER's concept for the Master Planned Community identifying areas of the PROPERTY proposed to be developed as: residential, professional, office, commercial, industrial, retail and such other compatible uses authorized by the Code. The map also identifies areas of the PROPERTY to be used for public facilities, recreational purposes and open space purposes. Without granting to DEVELOPER any development rights, by approval of this AGREEMENT, COUNTY agrees that DEVELOPER's concept as shown on the land use map, complies with the requirement of the MOU for master planning of the PROPERTY.

3.02 Master Planned Community. DEVELOPER shall develop the PROPERTY into a Master Planned Community which shall be more fully defined by the DEVELOPMENT AGREEMENT, and which shall contain or provide:

- 3.02.1 that industrial development shall be permitted on no more than ten (10%) of the Developable Acres;
- 3.02.2 that non-industrial and non-residential uses shall be governed according to mutually agreed to zoning ordinances between COUNTY and DEVELOPER;
- 3.02.3 for zoning of the Public Use Acreage for public uses only.
- 3.02.4 for the conveyance of the Public Use Acreage to the COUNTY and/or Lincoln County School District;
- 3.02.5 that the overall residential density shall not exceed 3.3 units per Developable Acres;

- 3.02.6 that a minimum of one (1) golf course(s) shall be available for play to the general public and related facilities;
- 3.02.7 for a master development plan for the PROPERTY;
- 3.02.8 for a comprehensive drainage study for the PROPERTY;
- 3.02.9 for a comprehensive transportation study prepared for the PROPERTY;
- 3.02.10 for a comprehensive facilities plan for the PROPERTY which shall include sewer, sewer treatment facilities, potable water, reservoir, dry utilities and a utility corridor study;
- 3.02.11 for such studies, surveys and plans as necessary to establish boundary lines in a Master Boundary and Right-of-way/Easement Plan which shall include any boundary adjustments, and existing and proposed utility easements and roadway rights-of-way; a Master Survey Control Plan referenced to the Nevada Coordinate System; and a Selective Site Specific Geotechnical Investigation/Analysis Report for public facilities sites;
- 3.02.12 for a plan for identifying and protecting significant cultural or paleontological resources on the PROPERTY;
- 3.02.13 for such other studies and plans as may be required by the COUNTY.

3.03 Master Planned Community Review Team. In order to facilitate the DEVELOPMENT AGREEMENT, and the ultimate development of the PROPERTY, the COUNTY agrees to establish a Master Planned Community Review Team. It is intended that the team would assist in finalizing the terms of the DEVELOPMENT AGREEMENT. Any further duties of the Review Team will be set forth in the final DEVELOPMENT AGREEMENT.

SECTION 4. AGREEMENT PRINCIPLES

4.01 Development Principles. DEVELOPER acknowledges that the DEVELOPMENT AGREEMENT will require certain agreements, concessions, contributions and improvements in order for DEVELOPER to develop the PROPERTY, some of which are:

- 4.01.1 Water Conservation. DEVELOPER shall encourage water conservation in the Master Planned Community DEVELOPER agrees to design any golf course(s), streetscape areas, park space

and any other open space using water conserving techniques, including but not limited to proper soil preparation and water conserving plant materials, irrigation systems and equipment. DEVELOPER shall establish design criteria on all development within the Master Planned Community that will encourage water conservation in all landscaping treatments by incorporating reuse and gray water.

4.01.2 Reuse Water. DEVELOPER may be required, in connection with any golf course, to irrigate such golf course with treated effluent. DEVELOPER will, to the maximum extent practical, irrigate nearby park space and landscape areas with properly treated effluent.

4.01.3 Public Safety, Governmental Services and School Sites and Facilities. DEVELOPER shall at its sole cost and expense, provide to COUNTY cash contribution or sites and facilities sufficient to serve the public needs of the proposed Master Planned Community. Such sites and facilities shall be substantially similar to and appropriate for population densities and distributions such as are currently existing within the City of Mesquite and which are anticipated to exist within the PROPERTY. Such sites and facilities will be part of the Public Use Acreage pursuant to the DEVELOPMENT AGREEMENT and shall be for the following purposes:

Fire Stations,
Sheriff Substations,
Governmental Services Annex,
School sites and facilities

Provisions of such sites and facilities may be addressed within the DEVELOPMENT AGREEMENT on a phased basis according to need as shall be established by population growth, densities and distributions.

4.01.4 Park Dedication Requirements. DEVELOPER shall dedicate to COUNTY all of the Public Use Acreage for public recreational purposes, pursuant to a master parks and recreation plan. All the Public Use Acreage shall be zoned for public use only.

4.01.5 Park Improvements. DEVELOPER and COUNTY shall enter into a master parks and recreation plan, which shall:

4.01.5.1 identify the portion of the Public Use Acreage for development as parks, which shall be not less than 5

acres per 1,000 residents, based on the density cap as identified in Section 3.02.5;

- 4.01.5.2 identify the location of the parks upon the PROPERTY;
- 4.01.5.3 identify the location of all Public Use Acreage upon the PROPERTY;
- 4.01.5.4 require DEVELOPER to, at its sole cost and expense, design, develop and construct specified park acreage into park and trail sites prior to dedication to the COUNTY;
- 4.01.5.5 provide for method of payment or credit against residential construction tax, but no credit shall be given DEVELOPER for the value of the Public Use Acreage;

- 4.01.6 Landfill Expansion Site. Developer shall dedicate to the COUNTY acreage for expansion of the existing City of Mesquite landfill for the benefit of the COUNTY and City or if the expansion area is not within the DEVELOPER'S lands shall provide to the COUNTY a cash contribution to provide for said landfill expansion.
- 4.01.7 Development Standards. Development of the PROPERTY shall be in accordance with the Uniform Standard Specifications and Drawings for Public Works Construction, Offsite Improvements, Clark County Area Nevada as adopted by the City of Mesquite and by Lincoln County. Copies of these standards are available through the Clark County Regional Transportation Commission.
- 4.01.8 All lands which are part of the LCLA shall be included in and shall be part of the Lincoln County Multi-Species Habitat Conservation Plan (MSHCP).
- 4.01.9 County will not authorize, grading or issue a building permit on LCLA lands until either: (1) the Lincoln County Multiple-Species Habitat Conservation Plan has been completed and a Section 10 Permit issued to the County by U.S. Fish and Wildlife Service; (2) Developer has prepared an individual Habitat Conservation Plan and U.S. Fish and Wildlife Service has issued a related Section 10 Permit; or (3) Developer has paid the U.S. Fish and Wildlife Service mitigation fees pursuant to Section 7 of the Endangered Species Act..

SECTION 5.
TIMING

5.01 Deadline for Formal Development Agreement. This AGREEMENT contemplates that the parties will have entered into a DEVELOPMENT AGREEMENT on or before _____, 2001. DEVELOPER acknowledges that COUNTY will have no obligation to consider, and will not consider, any application relating to any development of the PROPERTY until such time as the DEVELOPMENT AGREEMENT is finalized and the DEVELOPER receives the Patent for the PROPERTY from BLM. Both parties agree to use their best efforts to finalize the DEVELOPMENT AGREEMENT.

SECTION 6.
MISCELLANEOUS

6.01 Assignment.

6.01.1 To an Affiliate of Developer. The rights of DEVELOPER under this AGREEMENT may be freely transferred or assigned to any entity, partnership or corporation which DEVELOPER controls or in which DEVELOPER has a controlling interest or which controls DEVELOPER; provided, such entity is identified on Exhibit "B" attached hereto, or is an affiliate approved by COUNTY. The entity must assume in writing all obligations of DEVELOPER hereunder. In connection with a transfer of any portion of the PROPERTY pursuant to this Subsection 6.01.1, DEVELOPER shall provide COUNTY with written notice of such transfer. Such assignment or transfer shall not relieve DEVELOPER of its obligations under this AGREEMENT.

6.01.2 To a Third Person. COUNTY acknowledges that as a Master Developer, DEVELOPER may wish to assign, sell or transfer part of the PROPERTY to a third person developer, however, DEVELOPER shall not assign, sell or transfer any portion of the PROPERTY without the written consent of COUNTY. DEVELOPER shall, prior to any assignment, sale or transfer, certify to COUNTY that a Master Plan Development Agreement is in force between DEVELOPER and third person. Such Master Plan Development Agreement shall include, as a minimum, fully developed, approved and recorded CC&R's, phasing and sequencing agreements relating to timing of development and zoning ordinances for the portion of the PROPERTY to be assigned, sold or transferred.

6.01.3 Reimbursement Agreement. The COUNTY and DEVELOPER agree that reimbursement agreements between DEVELOPER,

neighboring developers, Third Person Developers and COUNTY may be necessary to facilitate the orderly development of PROPERTY and all LCLA lands. Nothing in this AGREEMENT is intended to disallow reimbursement agreements as deemed appropriate by COUNTY.

6.01.4 Transfer Not to Relieve DEVELOPER of its Obligation. Unless provided in writing by the COUNTY as part of COUNTY's consent to a transfer, an assignee or transferee of any portion of the PROPERTY shall be subject to the obligations of DEVELOPER as to the portion of the PROPERTY so assigned or transferred and such transferee shall be deemed to have assumed all such obligations. Unless provided in writing by the COUNTY as part of COUNTY's consent to a transfer, any assignment or transfer shall not relieve DEVELOPER of its obligations as to the assigned or transferred portion of the PROPERTY .

6.02 Amendment or Cancellation of Agreement. This AGREEMENT may be amended from time to time or canceled only upon the mutual written consent of the parties hereto.

6.03 Indemnity: Hold Harmless. Except as expressly provided in this AGREEMENT, DEVELOPER shall hold COUNTY, its officers, agents, employees, and representatives harmless from liability for damage or claims for damage for personal injury, including death and claims for PROPERTY damage which may arise from the direct or indirect operations of DEVELOPER or those of its contractors, subcontractors, agents, employees, or other persons acting on DEVELOPER's behalf which relate to the development of the Master Planned Community DEVELOPER agrees to and shall defend COUNTY and its officers, agents, employees, and representatives from actions for damages caused or alleged to have been caused by reason of DEVELOPER's activities in connection with the development of the Master Planned Community. DEVELOPER and COUNTY agree to jointly defend this AGREEMENT in any legal action filed in a court of competent jurisdiction by a third party challenging the validity of this AGREEMENT. The provisions of this Section shall not apply to the extent such damage, liability, or claim is proximately caused by the intentional or negligent act of COUNTY, its officers, agents, employees, or representatives.

6.04 Binding Effect of this Agreement. Subject to Section 6.01 hereof, the burdens of this AGREEMENT bind, and the benefits of this AGREEMENT inure to, the parties' respective successors in interest.

6.05 Relationship of Parties. It is understood that the contractual relationship between COUNTY and DEVELOPER is such that DEVELOPER is an independent contractor and not an agent of COUNTY for any purpose.

6.06 Notices. All notices required to be given hereunder shall be in writing and addressed as follows. Each party may designate from time to time, another address in place of the address below set forth by notifying the other parties in the same manner as provided in this paragraph.

To COUNTY:

With a copy to (Include City)

To DEVELOPER:

With a Copy to: (Include City)

Delivery shall be accomplished only in accordance with one of the following procedures. Email communications shall not constitute notice:

- A. By personal (hand) delivery to a party, and if a party is an entity, to an adult representative of such party, at the street address for the party, whereupon notice shall be deemed given upon the day of receipt or refusal to accept.
- B. By the United States mail to the street address whereupon notice shall be deemed given two (2) days after deposit with the United States Postal Service by certified or registered mail, postage prepaid, with return receipt requested.
- C. By a nationally recognized delivery service company to the street address with written proof of delivery, whereupon notice shall be deemed given upon the day of receipt or refusal to accept.
- D. By facsimile transmission to a party's facsimile number, provided sender possesses written proof of successful transmission printed contemporaneously by the transmitting device, whereupon notice shall be deemed given upon the day of transmission, if transmitted before 5:00 p.m. recipient time, otherwise the next day.

In the event any applicable statute, law, rule or regulation requires notice to be delivered in a particular manner, or to a particular address for a party, such statute, law, rule or regulation shall control, unless the requirements of such statute, law, rule or regulation can be waived in which case all parties to this AGREEMENT hereby waive such requirements.

6.07 Entire Agreement. This AGREEMENT constitutes the entire understanding and agreement of the parties. This AGREEMENT integrates all of the terms and conditions mentioned herein or incidental hereto and supersedes all negotiations or

previous agreements between the parties with respect to all or any part of the subject matter hereof.

6.08 Recording. The parties hereto agree to the recordation of the specific DEVELOPMENT AGREEMENT and that the terms and conditions of the specific development agreement are to run with the land.

6.09 Waivers. All waivers of the provisions of this AGREEMENT must be in writing and signed by the appropriate officers of COUNTY or DEVELOPER, as the case may be.

6.10 Recording. Amendments. This AGREEMENT shall be recorded. Any amendment hereto must be in writing signed by the appropriate officers of COUNTY and DEVELOPER

6.11 Headings. Exhibits: Cross-References. The headings and captions used in this AGREEMENT are for convenience and ease of reference only and shall not be used to construe, interpret, expand or limit the terms of this AGREEMENT. All exhibits attached to this AGREEMENT and the recitals at the front of this AGREEMENT are incorporated herein by the references thereto contained herein. Any term used in an exhibit hereto shall have the same meaning as in this AGREEMENT unless otherwise defined in such exhibit. All references in this AGREEMENT to sections and exhibits shall be to sections and exhibits of or to this AGREEMENT, unless otherwise specified.

6.12 Severability of Terms. If any term or other provision of this AGREEMENT is held to be invalid, illegal or incapable of being enforced by any rule of law or public policy, all other conditions and provisions of this AGREEMENT shall nevertheless remain in full force and effect, provided that the invalidity, illegality or unenforceability of such term does not materially impair the parties' ability to consummate the transactions contemplated hereby. If any term or other provision is invalid, illegal or incapable of being enforced, the parties hereto shall, if possible, amend this AGREEMENT so as to effect the original intention of the parties.

[THE BALANCE OF THIS PAGE LEFT INTENTIONALLY BLANK]
SIGNATURES ON NEXT PAGE

IN WITNESS WHEREOF, this AGREEMENT has been executed by the parties on the day and year first above written.

COUNTY:

LINCOLN COUNTY, NEVADA

By: _____

Attest:

DEVELOPER:

By: _____

Print Name: _____

Its: _____

STATE OF NEVADA)

) ss.

COUNTY OF CLARK)

This instrument was acknowledged before me on the _____ day of _____, 2001, by _____ as ~~-[title]-~~ of [DEVELOPER].

IN WITNESS WHEREOF, this AGREEMENT has been executed by the parties on the day and year first above written.

NOTARY PUBLIC

Participation Agreement Template

Draft Participation Agreement

Southeastern Lincoln County Habitat Conservation Plan

The U.S. Fish and Wildlife Service has issued an Incidental Take Permit to Lincoln County under the Endangered Species Act, 16 U.S.C. § 1539 (a)(1)(B). This permit allows for the limited take of certain species (listed below) by non-Federal landowners included in the Southeastern Lincoln County Habitat Conservation Plan (SLCHCP) Covered Area. Your acceptance of the conservation measures included in the SLCHCP will afford you protection from prosecution for violations of the Endangered Species Act when conducting development activities in habitat related to specific species as listed below.

By signing and accepting this agreement, you signify your election to receive take authorization under the terms and conditions set forth in the section 10(a)(1)(B) permit issued for the SLCHCP and in accordance with Section 6 “Conservation Measures” of the SLCHCP; Section 8.0 “Extension of Take to Third Party participants by Participation Agreement” of the Implementing Agreement for the SLCHCP; and Section 3 “Description and Comparison of Preferred Alternative and Alternatives” of the EIS for the SLCHCP, as well as other Sections of the SLCHCP, the IA and the EIS as may be applicable to your proposed land action.

Desert Tortoise

I, Type Name, accept the SLCHCP conservation measures related to desert tortoise habitat and agree to participate in the SLCHCP. I understand that abiding by the SLCHCP conservation measures that I will have protection under the SLCHCP for my development on APN number.

Southwestern Willow Flycatcher

I, Type Name, accept the SLCHCP conservation measures related to southwestern willow flycatcher and agree to participate in the SLCHCP. I understand that abiding by the SLCHCP conservation measures that I will have protection under the SLCHCP for my development on APN number.

Legal Name of Landowner _____

Address _____ City/State _____

Authorized Signature _____

Printed Name and Title _____ Date _____

Signature of Witness _____ Printed
Name _____

Address _____ Date _____

NOTE: The above documents, Southeastern Lincoln County Habitat Conservation Plan, Implementing Agreement for the SLCHCP and the Environmental Impact Statement for the SLCHCP are available on the Lincoln County official website at:

www.lincolncountynv.org

Draft Participation Agreement

Southeastern Lincoln County Habitat Conservation Plan

The U.S. Fish and Wildlife Service has issued an Incidental Take Permit to City of Caliente under the Endangered Species Act, 16 U.S.C. § 1539 (a)(1)(B). This permit allows for the limited take of certain species (listed below) by non-Federal landowners included in the Southeastern Lincoln County Habitat Conservation Plan (SLCHCP) Covered Area. Your acceptance of the conservation measures included in the SLCHCP will afford you protection from prosecution for violations of the Endangered Species Act when conducting development activities in habitat related to specific species as listed below.

By signing and accepting this agreement, you signify your election to receive take authorization under the terms and conditions set forth in the section 10(a)(1)(B) permit issued for the SLCHCP and in accordance with Section 6 “Conservation Measures” of the SLCHCP; Section 8.0 “Extension of Take to Third Party participants by Participation Agreement” of the Implementing Agreement for the SLCHCP; and Section 3 “Description and Comparison of Preferred Alternative and Alternatives” of the EIS for the SLCHCP, as well as other Sections of the SLCHCP, the IA and the EIS as may be applicable to your proposed land action.

Desert Tortoise

I, Type Name, accept the SLCHCP conservation measures related to desert tortoise habitat and agree to participate in the SLCHCP. I understand that abiding by the SLCHCP conservation measures that I will have protection under the SLCHCP for my development on APN number.

Southwestern Willow Flycatcher

I, Type Name, accept the SLCHCP conservation measures related to southwestern willow flycatcher and agree to participate in the SLCHCP. I understand that abiding by the SLCHCP conservation measures that I will have protection under the SLCHCP for my development on APN number.

Legal Name of Landowner _____

Address _____ City/State _____

Authorized Signature _____

Printed Name and Title _____ Date _____

Signature of Witness _____ Printed
Name _____

Address _____ Date _____

NOTE: The above documents, Southeastern Lincoln County Habitat Conservation Plan, Implementing Agreement for the SLCHCP and the Environmental Impact Statement for the SLCHCP are available on the Lincoln County official website at:

www.lincolncountynv.org

APPENDIX D

Original Technical Steering
Committee and Members

Technical Steering Committee Members

Mr. Dan Frehner, Lincoln County Commission	Ms. Janet Bair, U.S. Fish and Wildlife Service
Ms. Rhonda Hornbeck, Lincoln County Commission	
Mr. Allen Bell, City of Mesquite	Mr. Brad Hardenbrook, Nevada Department of Wildlife
Mr. Laren Flake, Lincoln County Farm Bureau	Mr. Rob Scanland, The Nature Conservancy
Mr. Jim Perkins, Bureau of Land Management Ely Field Office	Mr. Varlin Higbee, Lincoln County Public Land Commission
Ms. Julie Erven-Holoubek, Nevada Department of Transportation	Mr. Carl Savely, Lionel, Sawyer and Collins (Landowner Interests)
Mr. Bryan Elkins, City of Caliente	Mr. Bill James, Sierra Club
Mr. Bob Maxwell, Union Pacific Railroad	Mr. Mike Del Grosso, Nevada Division of State Lands
Mr. Dennis Sonnenberg, (Mining Interests)	Mr. Phil Trousdale, (Sportsmen Interests)
Mr. Keith Pearson, (OHV Interests)	Mr. Keith Whipple, (Landowner Interests)
Mr. Larry Wisbeck, Lincoln County Planning Commission	Ms. Linda Lytle, N-4 State Grazing Board
Mr. Louie Cole, Utility interests	

Other Persons Providing Technical Assistance to the Steering Committee:

Mike L. Baughman, Ph.D., Intertech Services Corporation, Facilitator
Mr. Marvin Tebeau, Resource Concepts, Inc., Technical Consultant
Ms. Lynn Zonge, Resource Concepts, Inc., Technical Consultant
Ms. Jeri Krueger, U.S. Fish and Wildlife Service
Mr. John Hiatt, Red Rock Audubon Society

BioWest Post-Flood Vegetation Assessment (2005)



MEADOW VALLEY WASH

Post-flood Vegetation Assessment

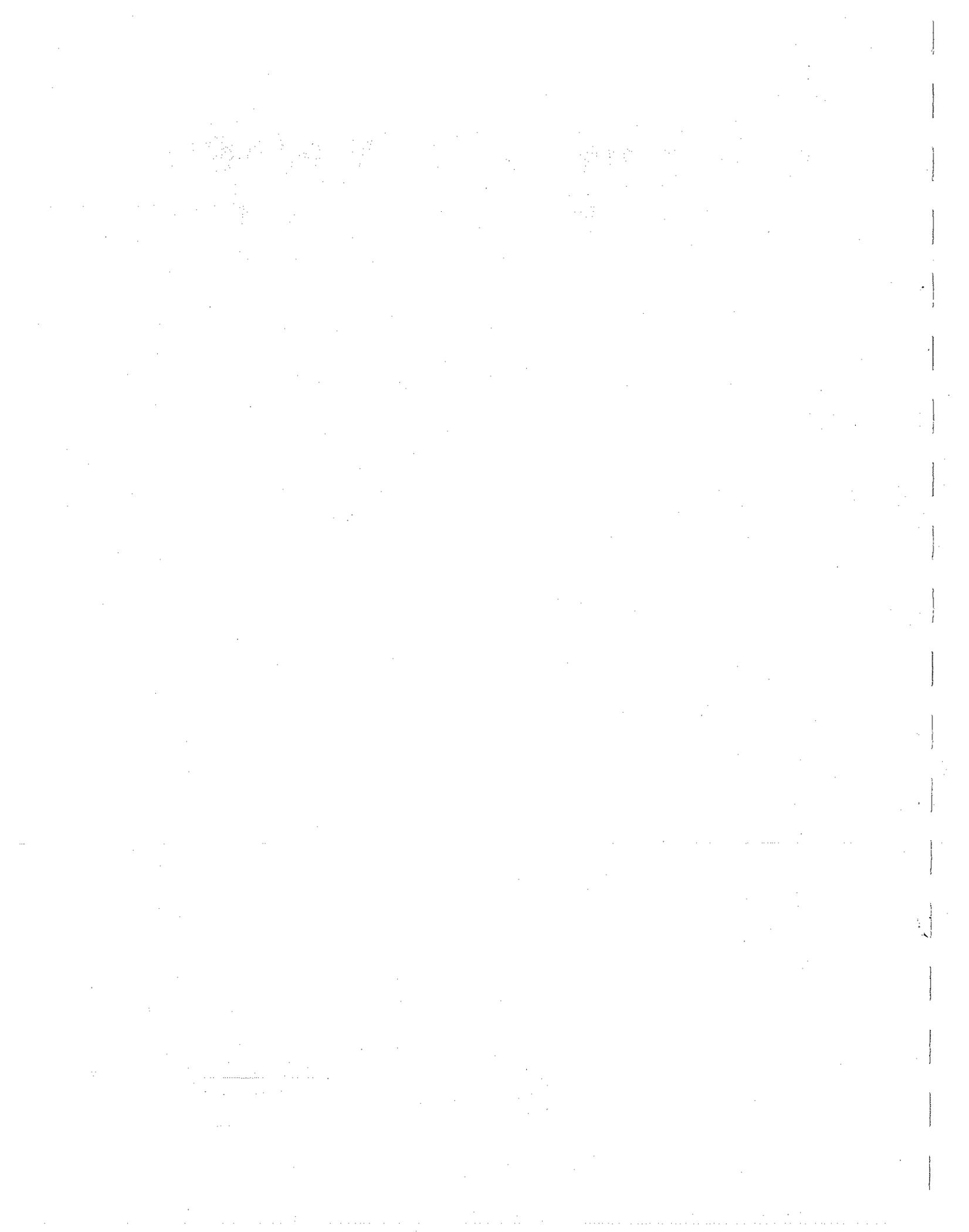
Submitted to:
U.S. Department of the Interior
Bureau of Land Management
Ely Field Office
702 N. Industrial Way
Ely, Nevada 89301

Submitted by:
BIO-WEST, Inc.
1063 West 1400 North
Logan, Utah 84321

September 2005



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PREFACE ON MAP AND DATA AVAILABILITY

The Meadow Valley Wash Post-flood Evaluation was funded by the United States Department of Interior, Bureau of Land Management (BLM). As part of the assessment, GIS data sets and maps of post-flood vegetation changes were prepared and submitted to the BLM Ely Field Office, Ely, Nevada. The maps and graphics included the following material, and are available for review at the Ely office.

1. *Three-band Digital Rectified Images, Meadow Valley Wash and Clover Creek.* This is the 3-band imagery captured in June 2005 for both Clover Creek and Meadow Valley Wash.
2. *Two Composite GIS Shapefiles.* These shapefiles cover both Meadow Valley Wash and Clover Creek. One GIS shapefile depicts the overall changes by disturbance type (natural or human) and is delineated into polygons by disturbance type only, without reference to prior vegetation mapping. The second shapefile shows the same information, but polygons are split to depict extent within the original vegetation mapping boundary and the area beyond this boundary.
3. *Post-flood Clover Creek GIS Shapefiles.* One shapefile is the original vegetation delineation (pre flood, dated 2003). The second shapefile is the post-flood delineation of disturbance (by type of disturbance and vegetation type). This is the composite disturbance intersected with the original vegetation. No Southwestern Willow Flycatcher Habitat (SWWFC) data was available for Clover Creek.
4. *Post-flood Meadow Valley Wash GIS Shapefiles.* One shapefile is the original vegetation delineation (pre flood, dated 2003). The second is the post-flood delineation of disturbance (by type of disturbance and vegetation type). This is the composite disturbance intersected with the original vegetation and SWWFC Habitat data.
5. *Atlas of Post-flood Disturbance in Relation to Pre Flood Vegetation and SWWFC Habitat.* This atlas depicts all of the vegetation disturbance by type of disturbance in relation to pre flood vegetation classification and SWWFC habitat. The base map is the June 2005 imagery.

Because of the large size and complexity of the graphics and maps, it was not practicable to include this full array with the current report.

One DVD is included in the back cover of the report containing the *Atlas of Post-flood Disturbance in Relation to Pre Flood Vegetation and SWWFC Habitat*. The DVD contains readable files showing all of the vegetation disturbance by type of disturbance in relation to pre flood vegetation classification and SWWFC habitat. The base map is the June 2005 imagery. The scale is 1:24,000. An index map is included for location reference as well as a legend explaining symbols.

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INTRODUCTION

Within the arid Southwest, the desert riparian ecosystem supports a diverse array of wildlife species, many of which are restricted to the limited habitat components supported by local hydrology. The desert riparian system has historically provided essential habitat components for species, particularly avian species, that have limited distribution or are experiencing population declines across their ranges. The Meadow Valley Wash of southeastern Nevada comprises a variable desert riparian ecosystem punctuated by diverse geologic, hydrologic, and anthropogenic conditions that affect the amount, distribution and structure of the differing riparian vegetation within the system. The vegetation type, distribution, and structural characteristics, subsequently, determine available wildlife habitat within Meadow Valley Wash.

In September 2003 BIO-WEST, Inc. (BIO-WEST), of Logan, Utah, was contracted by Lincoln County and Clark County, Nevada, to prepare the baseline ecological assessment of Meadow Valley Wash. The project was funded through a matching grant from the U.S. Department of Interior (USDI), Fish and Wildlife Service (USFWS) under Section 6 of the Endangered Species Act. The goal of the baseline ecological assessment was to characterize and evaluate riparian communities within the Meadow Valley Wash in order to identify riparian sites that could be protected, enhanced, or restored in compliance with the Multiple Species Habitat Conservation Plans for the Counties (MSHPC) (Clark County 2000, Lincoln County 2003). The baseline ecological assessment focused primarily on the identification of suitable habitat and potentially suitable habitat for covered species, with particular emphasis on the southwestern willow flycatcher (*Empidonax traillii extimus*) (SWWFC). Suitable habitat for covered species was evaluated based on riparian vegetation composition and structure, habitat patch size, presence of surface water, and other elements that appear to affect a covered species' affinity for a habitat patch. Riparian conditions were assessed not only for suitable habitat, but also for habitat patches that could potentially develop suitable conditions for covered species, specifically for the SWWFC.

The baseline ecological assessment defined the condition of riparian communities in the Meadow Valley Wash as of July 2004 and a final report was prepared in early January 2005 (BIO-WEST 2005).

On January 11, 2005 extensive precipitation events in southeastern Nevada culminated with catastrophic flooding of a number of the local drainages, including Meadow Valley Wash and its tributary, Clover Creek. The flood event affected riparian vegetation and floodplain characteristics through Clover Creek and Meadow Valley Wash from Caliente, Nevada, through its confluence with Muddy Creek

In May 2005 the Ely, Nevada, district of the USDI Bureau of Land Management (BLM), contracted with BIO-WEST to conduct a post-flood evaluation of the riparian changes in the Meadow Valley Wash and its major tributary, Clover Creek (Study). The objective of the post-flood Study was to determine the extent of riparian changes caused by winter 2005 flooding and by subsequent human activities to restore and/or protect infrastructure within or adjacent to the floodplain. This report summarizes the results of the post-flood evaluation.

STUDY AREA

Meadow Valley Wash drains a substantial portion of southeast Nevada, extending about 110 miles in a general north-south direction from a northern origin in the Wilson Creek Range of eastern Lincoln County to a southern confluence with the Muddy River in Clark County. The drainage originates in the Great Basin physiographic region, but after approximately 30 miles it enters the Mojave Desert physiographic region and continues through the Mojave Desert to its confluence with the Muddy River. Provencher et al. (2003) identified the Meadow Valley Wash as ecologically significant because it is the only remaining corridor of bird migration between the Mojave Desert and Great Basin with a large amount of native riparian vegetation.

The Study Area (Figure 1) for the post-flood evaluation comprises approximately 85 miles of the lower-elevation portion of the Meadow Valley Wash main channel, which extends through the area covered by the Southeastern Lincoln County MSHCP and the Clark County MSHCP. Approximately 70 miles of the Study Area is within Lincoln County, and 15 miles is within Clark County. The Study Area includes the general floodplain of the Meadow Valley Wash from about 1 mile north of Caliente (T4S R67E NE 1/4 NW 1/4, Section 5) to the confluence of Meadow Valley Wash and Muddy River immediately east of Glendale, Nevada (T15S R66E NW 1/4 NE 1/4 Section 2). The elevation grades from 4,434 feet above sea level at the northern Study Area terminus to 1,520 feet above sea level at the confluence with the Muddy River at the southern terminus. The Study Area is primarily within the Mojave Desert, although the northern section through the Rainbow Canyon to Caliente is transitional to the Great Basin.

In addition to the area included in the baseline ecological assessment, the Study Area of the post-flood evaluation also includes the lower 14 miles of Clover Creek from its confluence with Meadow Valley Wash at Caliente upstream to approximately 1 mile northeast of Big Springs, Nevada (T5S R68E NW 1/4 NE 1/4 Section 11). Clover Creek is considered an important perennial tributary of Meadow Valley Wash (Provencher et al. 2003).

All of the water in Meadow Valley Wash comes from precipitation in the mountains. On average, the Meadow Valley Wash in the Mojave Desert portion receives 4-6 inches of rain annually, while the northern portion in the Great Basin receives 8-14 inches of rain annually (Provencher et al. 2003). Flash flooding has been frequently reported in the Meadow Valley Wash between Caliente and Rox, Nevada. Catastrophic flood events have also been reported, primarily during the first half of the 1900s (Averett 1995).

Railroad development in the Study Area began near the turn of the 20th Century. The rail line through the Meadow Valley Wash from Moapa, Nevada on the south to Caliente on the north became an integral section of the Union Pacific Railroad transcontinental system during the early 20th Century (Averett 1995). The Union Pacific Railroad continued east from Caliente through Clover Creek, one of the primary tributaries of Meadow Valley Wash, and continued north to Salt Lake City, Utah. The Union Pacific Railroad induced the development of towns in Nevada within the Meadow Valley Wash including Caliente, Elgin, Leith, and Carp (Averett 1995, Provencher et

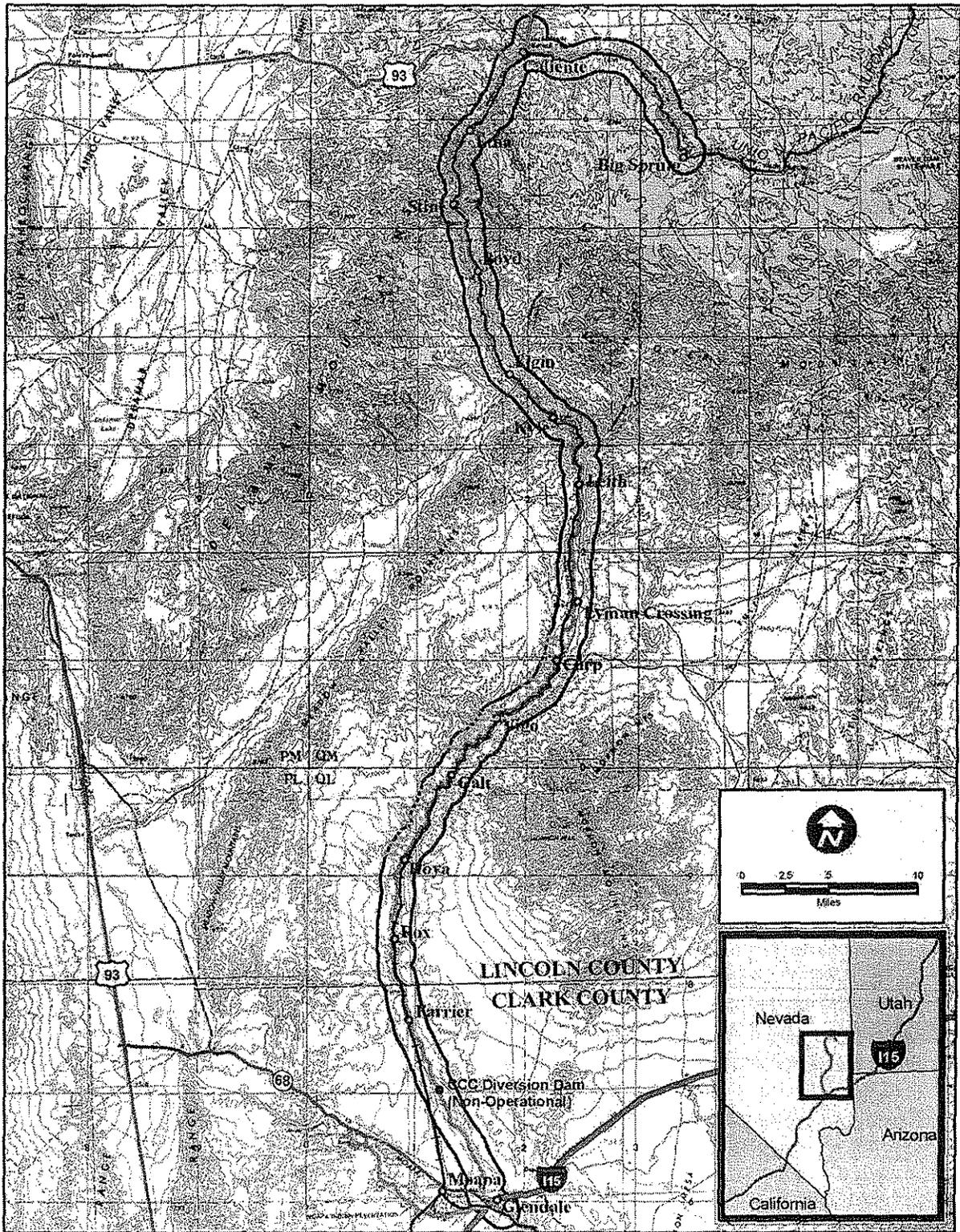


Figure 1. Meadow Valley Wash Post-flood Evaluation Study Area.

al. 2003). The railroad has also had a substantial effect on the geomorphology, hydraulics, and subsequent vegetation communities within the Meadow Valley Wash by disconnecting the floodplain from the river and dredging operations (Provencher et al. 2003).

Within the Study Area, as with the Meadow Valley Wash in general, land ownership is predominantly public, primarily managed by the BLM. The overall Meadow Valley Wash is approximately 97 percent public lands with the remaining 3 percent privately owned, principally along Meadow Valley Wash (Provencher et al. 2003). Within the area between Caliente and Moapa, public land ownership is approximately 92 percent with the remaining 8 percent privately owned, again primarily along Meadow Valley Wash.

METHODS

The methods employed in this study were based on those proposed in the contractor's contractual scope of work. These methods were developed to permit a valid comparison with the ecological baseline evaluation previously conducted by BIO-WEST (BIO-WEST 2005). In summary, the methods were developed (1) to permit identification of changes in vegetation within the general floodplain of the Study Area, (2) to describe the apparent cause of the change, and (3) to identify the type of vegetation changed and the value of the vegetation changed with regard to SWWFC. It is important to note that the identified changes were as of the date that new aerial imagery was acquired: on June 4, 2005, approximately 5 months after the flood event of January 11, 2005.

Aerial Imagery

High-resolution, digital 3-band, multispectral imagery was acquired so that a width of approximately 3,300 feet at approximately 1.6 feet-pixel resolution would cover the entire Meadow Valley Wash floodplain. The imagery was acquired for the complete 85 miles of the Meadow Valley Wash Study Area, as well as the 14 miles of Clover Creek from approximately Big Springs to the confluence with Meadow Valley Wash. The imagery was acquired on June 4, 2005. Sky conditions were clear and cloudless, and images were captured on three narrow spectral bands centered in the green, red, and near-infrared portions of the electromagnetic spectrum. The imagery acquisition was conducted by EMARS of Logan, Utah, the same firm that conducted the imagery acquisition for the baseline ecological assessment of 2004. The methods of acquisition were the same as described for that assessment (BIO-WEST 2005). The individual 3-band images were then rectified through a polynomial method in Erdas Imagine 8.6 to the original rectified imagery from the baseline ecological assessment of 2004 (BIO-WEST 2005) using common control points visible in both sets of imagery. The rectified images were then color-balanced, mosaicked, and clipped to tiles for the reaches of Meadow Valley Wash and Clover Creek.

Vegetation Community Aggregation

The original baseline ecological assessment classified the vegetation and land types (e.g., roads, railroads) within the floodplains of Meadow Valley Wash and Clover Creek (BIO-WEST 2005). This classification permitted the identification and segregation of vegetation communities at a minimum mapping area of 0.25-acre polygons for the Meadow Valley Wash floodplain. The areas of Meadow Valley Wash outside of the floodplain, but within the acquired imagery, were not classified nor delineated to minimum 0.25-acre mapping units during the original study. The baseline ecological evaluation was confined solely to the floodplain/riparian areas. Although an initial imagery classification was performed on the Clover Creek riparian corridor during the baseline ecological assessment, the scope of that assessment did not include a vegetation community delineation or riparian assessment of Clover Creek. As part of the post-flood evaluation, the unprocessed Clover Creek imagery classification from the original study was vectorized as to discrete vegetation communities using an aggregation technique. This technique aggregated the previously classified vegetation into discrete polygons based on the dominant vegetation type. The methods of aggregation are as described in the original baseline ecological assessment (BIO-WEST 2005). However, the aggregation into community types were not field verified or refined as in the original study. Without field refinement, the accuracy of vegetation community typing outside the boundaries evaluated in the original baseline ecological assessment (BIO-WEST 2005) cannot be certified. As such, the classification and aggregation for Clover Creek does provide an understanding of general vegetation community types changed by flood and post-flood events.

Because vegetation classification through reflective signatures was not conducted for boundary areas beyond the floodplains of Clover Creek and for outlying areas of Meadow Valley Wash, 172 acres of post-flood vegetation change in Meadow Valley Wash and 30 acres of post-flood vegetation change in Clover Creek did not have associated vegetation classifications. It was only possible to describe these areas as vegetated or not vegetated in pre-flood conditions. A subsequent field investigation would be needed in these outlying areas to delineate the vegetation type changed under post-flood conditions.

Vegetation Change Detection

Aerial Imagery Interpretation

The original multi-spectral imagery obtained in September 2003 as part of the original baseline ecological assessment was used as the basis for comparison with the new imagery obtained in June 2005. The September 2003 digital imagery was overlain with the new imagery acquired in June 2005 to determine where changes in vegetation occurred. Because the vegetation had been previously classified and segregated to vegetation communities, no interpretation of vegetation types was required. Changes were only delineated where vegetation was identified as missing; that is, bare ground and areas of substantially reduced vegetation density were denoted. The aerial interpretation was conducted by the same geographic information system (GIS) specialists who conducted the original ecological baseline evaluation (BIO-WEST 2005).

Bare ground and areas of substantially reduced vegetation density were identified and delineated at 1:4,800 (1" = 400'). This resultant polygon shape file showed changes from pre-flood to post-flood conditions by delineating areas that were vegetated in the pre-flood imagery and have been replaced by bare soil in the post-flood imagery. A more detailed manual change analysis was then conducted to increase the accuracy of the changed vegetation identification. A swipe analysis was conducted of the entire project area. The manual change analysis ensured all areas with vegetation change were accurately digitized as discrete polygons. In addition, the manual change analysis provided a preliminary determination as to the cause of change – natural flood processes or human alteration. The preliminary identification of human caused alteration was based on the geometrical pattern of the alteration or the identification of new anthropogenic structures (e.g., roads, diversion structures). Polygons with linear or rectilinear configurations were preliminarily described as human alterations. Changed vegetation polygons were preliminarily delineated as follows:

1. Naturally denuded. An area where natural flood processes eliminated pre-flood vegetation.
2. Naturally thinned. An area where natural flood processes substantially reduced the density of pre-flood vegetation.
3. Human Disturbance – Bladed. An area where human activities included substantial mechanical blading and/or grading that eliminated pre-flood vegetation.
4. Human Disturbance – Structure. An area where human activities created new diversion structures, berms, piers, or other structures to protect infrastructure or divert surface water. Such activities resulted in elimination or substantial thinning of pre-flood vegetation.
5. Human Disturbance – Borrow Site. An area where human activities included excavation, which resulted in the elimination of pre-flood vegetation.
6. Human Disturbance – Road. An area where new roads or extensive road widening resulted in the elimination of pre-flood vegetation.
7. New Vegetation Community. An area where human activities resulted in the creation of new vegetation.

Field Verification

Between July 27 and July 31, 2005, an on-site field visit was conducted to review and verify the changed vegetation identified during the change analysis, which was prepared based on the aerial imagery. Prior to the field evaluation, an atlas of preliminary mapped changes in vegetation was overlain on a hard copy of the 2005 imagery at a scale of 1:6000 for field use.

The field investigator was the riparian specialist who conducted the riparian field assessments during the original baseline ecological assessment. The field verification was conducted using a helicopter flying at low elevations. Use of the helicopter permitted hovering and touch downs for detailed

evaluation. The entire Study Area was overflowed during field verification. Each polygon preliminarily identified as changed vegetation was investigated on site. The boundaries were verified and refined in the field, as warranted. In addition, the type of disturbance was verified or changed based on field observations. Additional information describing the disturbance was collected and mapped as appropriate. This included location and description of new structures, evidence of human activities (e.g., mechanical tracks), and areas of natural sediment deposition or scouring. In limited instances, the field investigation identified new areas of disturbance not identified through the imagery interpretation exercise. A total of 453 polygons were originally identified as post-flood changed vegetation.

Upon return from the field, all field revisions were digitized into the GIS database on-screen at 1:2,000, and a final GIS shape file of changed vegetation was compiled. All attributes related to the type of disturbance were changed, as appropriate, and the polygons were refined to 557 discrete areas of post-flood vegetation changes. Attributes for the changed vegetation polygons were refined and expanded to include the following:

1. Naturally denuded. An area where natural flood processes eliminated pre-flood vegetation.
2. Naturally thinned. An area where natural flood processes substantially reduced the density of pre-flood vegetation.
3. Human Disturbance – Bladed or Graded. An area where human activities involved substantial mechanical blading and/or grading that eliminated pre-flood vegetation.
4. Human Disturbance – Borrow Site. An area where soil and/or rock material was excavated resulting in the elimination of pre-flood vegetation.
5. Human Disturbance – Berm. An area where a new berm was created of soil and/or rock to protect infrastructure or contain surface water.
6. Human Disturbance – Bridge. A new bridge structure was emplaced, which, along with other mechanical disturbance adjacent to the bridge, resulted in elimination or substantial thinning of pre-flood vegetation.
7. Human Disturbance – Diversion. A new ditch was constructed to move surface water away from infrastructure.
8. Human Disturbance – Jetty. A new structure created of soil and/or rock material was constructed in association with existing infrastructure to deflect future floods.
9. Human Disturbance – New Channel. A section of the Meadow Valley Wash or Clover Creek channel was mechanically relocated away from human infrastructure to carry base flows.

10. Human Disturbance – New Fence. One new fence was installed that resulted in clearing a corridor through existing riparian vegetation.
11. Human Disturbance – New Road. A new road was bladed and graded through an area of pre-flood vegetation.
12. Human Disturbance – Widened Road. An area where extensive road widening resulted in the elimination of pre-flood vegetation.
13. Human Disturbance – Stream Crossing. An area where channel banks were leveled and the channel bottom stabilized to support equipment and vehicles crossing the stream.
14. New Marsh Community. An area of new marsh created through detention of surface water.

Vegetation Change Analysis

The resultant GIS shape file of changes was used to evaluate the post-flood vegetation changes by intersecting the shape file of changes with the shape file of vegetation type communities and the SWWFC habitat delineated in the original baseline ecological assessment (BIO-WEST 2005). This intersection, performed in ArcGIS 9.1, resulted in a new shape file that depicted the areas of vegetation change, and contained full attributes of change type, vegetation community, and SWWFC habitat information. This shape file was queried to tabulate and sort the following information:

1. Total acres of each vegetation type changed.
2. Acres of each vegetation type denuded or thinned as a result of natural flood events.
3. Acres of each vegetation type where post-flood human activities currently have replaced the vegetation type.
4. Total acres of SWWFC Suitable Habitat changed.
5. Acres of SWWFC Suitable Habitat changed as a result of natural flood events.
6. Acres of SWWFC Suitable Habitat where post-flood human activities currently have replaced the suitable habitat.
7. Total acres of SWWFC Potential Habitat changed.
8. Acres of SWWFC Potential Habitat changed as a result of natural flood events.
9. Acres of SWWFC Potential Habitat where post-flood human activities currently have replaced the suitable habitat.

RESULTS

Post-flood Vegetation Type Changes

An evaluation of Meadow Valley Wash and Clover Creek was conducted to determine the extent of vegetation change that has occurred since the catastrophic flood of January 11, 2005. The evaluation was conducted by comparing pre-flood vegetation captured in September 2003 digital imagery and delineated through ground verification in July 2004 to vegetation from post-flood conditions captured in June 2005 digital imagery.

The Meadow Valley Wash portion of the Study included a distance of approximately 85 miles from 1 mile north of Caliente south to the confluence of Meadow Valley Wash and Muddy River. The Clover Creek portion of the Study included a distance of approximately 14 miles from Big Springs west to the confluence with Meadow Valley Wash at Caliente. Based on linear distance, Meadow Valley Wash accounted for approximately 86 percent of the Study Area and Clover Creek accounted for approximately 14 percent.

A total of approximately 2,498 acres of vegetation was delineated as changed from pre-flood conditions (Table 1). Approximately 2,095 acres (84% of total change) were delineated as changed in Meadow Valley Wash, and approximately 403 acres (16% of total change) were delineated as changed in Clover Creek (Table 1). The percent of change within each portion of the Study Area (84% Meadow Valley Wash; 16% Clover Creek) is consistent with the spatial proportions between Study Area portions (86% Meadow Valley Wash; 14% Clover Creek).

Natural flooding appears to have changed approximately 1,641 acres of vegetation in the entire Study Area through denudation and thinning of vegetation (Table 1). This is approximately 66 percent of the delineated change in vegetation. Human disturbance was delineated over approximately 857 acres of pre-flood vegetation (Table 1). This is approximately 34 percent of the delineated change. However, it must be remembered that the changes were identified in July 2005, approximately 6 months after the catastrophic flood event of January 11, 2005. It is possible that some of the areas delineated as disturbed by human activities may have been initially disturbed by natural flood events.

Meadow Valley Wash

Table 2 presents a summary of the delineated post-flood vegetation disturbance described within Meadow Valley Wash. This table describes the type of disturbance identified in July 2005 and the pre-flood vegetation type affected. As can be interpreted from Table 2, most (68%) of the disturbance resulted from natural flood processes (approximately 1,434 acres).

Table 1. Summary of Post-flood Vegetation Disturbance in Meadow Valley Wash and Clover Creek (July 2005).

	NATURAL DENUDATION ^a	NATURAL THINNING ^b	HUMAN DISTURBANCE ^c	TOTAL DISTURBANCE
	Acres	Acres	Acres	Acres
RIPARIAN VEGETATION TYPES				
Meadow Valley Wash	545.14	287.87	133.80	966.81
Clover Creek	128.25	2.40	117.50	248.15
<i>Subtotals</i>	<i>673.39</i>	<i>290.27</i>	<i>251.30</i>	<i>1214.96</i>
UPLAND VEGETATION TYPES				
Meadow Valley Wash	531.60	69.58	527.05	1128.23
Clover Creek	75.20	1.16	78.34	154.70
<i>Subtotals</i>	<i>606.80</i>	<i>70.74</i>	<i>605.39</i>	<i>1282.93</i>
SUMMARY				
Meadow Valley Wash	1076.74	357.45	660.85	2095.04
Clover Creek	203.45	3.56	195.84	402.85
TOTALS	1280.19	361.01	856.69	2497.89

^a Natural Denudation describes areas where natural flood events appear to have eliminated all or most of the vegetation identified in the October 2003 Aerial Imagery.

^b Natural Thinning describes areas where natural flood events appear to have substantially reduced the density of the vegetation identified in the October 2003 Aerial Imagery.

^c Human Disturbance describes areas where mechanical processes or new structures appear to have eliminated all or most of the vegetation identified in the October 2003 Aerial Imagery.

Table 2. Meadow Valley Wash Summary of Post-flood Disturbance (July 2005).

VEGETATION TYPE / LAND USE	NATURAL DENUDATION ^a	NATURAL THINNING ^b	HUMAN DISTURBANCE ^c	TOTAL DISTURBANCE
	Acres	Acres	Acres	Acres
RIPARIAN VEGETATION TYPES				
Alluvium	281.38	3.49	31.45	316.32
Arrowweed Shrubland	40.42	6.39	2.35	49.16
Burnt or Dead Tamarisk	10.83	28.76	4.75	44.34
Bush Seepweed Shrubland	8.90	0.92	9.78	19.60
Cattail Marsh	18.17	1.15	2.48	21.80
Coyote Willow Shrubland	3.78	0.00	0.38	4.16
Desert Willow Shrubland	11.78	1.56	3.60	16.94
Fremont Cottonwood Forest	28.09	26.45	17.35	71.89
Mixed Marsh	0.00	0.00	0.62	0.62
Mixed Wet Meadow	2.54	0.21	0.02	2.77
Open Water	1.10	0.00	0.97	2.07
Red Willow Forest	4.38	11.19	0.02	15.59

Table 2. Meadow Valley Wash Summary of Post-flood Disturbance (July 2005) (cont.).

VEGETATION TYPE / LAND USE	NATURAL DENUDATION ^a	NATURAL THINNING ^b	HUMAN DISTURBANCE ^c	TOTAL DISTURBANCE
	Acres	Acres	Acres	Acres
Red Willow Shrubland	2.52	0.21	0.05	2.78
Riparian Forest	51.19	77.25	15.13	143.57
Riparian Forest Tamarisk Woodland Mix	15.14	15.95	19.13	50.22
Saltgrass Grassland	0.17	0.94	0.00	1.11
Seepwillow Shrubland	8.35	2.39	2.79	13.53
Tamarisk Woodland	56.40	111.01	22.93	190.34
Subtotals	545.14	287.87	133.80	966.81
UPLAND VEGETATION TYPES				
Creosote Bush Shrubland	34.92	14.71	25.14	74.77
Exposed Soil	0.43	0.00	0.00	0.43
Gambel Oak Shrubland	0.73	0.00	0.00	0.73
Greasewood Shrubland	2.62	0.06	0.05	2.73
Mesquite Shrubland	0.00	0.47	0.74	1.21
Mixed Canyon Shrubland	68.07	6.72	38.52	113.31
Mixed Desert Shrubland	171.44	10.78	175.47	357.69
Mixed Grassland	5.95	0.63	7.70	14.28
Pasture/Agricultural Lands	47.72	1.07	1.91	50.70
Quailbush Shrubland	0.03	0.02	4.73	4.78
Quarry	1.27	0.12	0.19	1.58
Rabbitbrush Shrubland	21.19	2.86	11.83	35.88
Railroad/Road	4.89	0.84	22.57	28.30
Sagebrush Shrubland	3.23	0.31	0.44	3.98
Shadscale Shrubland	7.82	2.06	17.92	27.80
Sparsely Vegetated/ Disturbed Lands	124.15	20.40	88.33	232.88
Upland Forest	0.00	5.32	0.00	5.32
Subtotals	494.46	66.37	395.54	956.37
UNDELINEATED VEGETATION TYPES^d				
Unknown Upland Vegetation	37.14	3.21	131.51	171.86
TOTALS	1076.74	357.45	660.85	2095.04

^a Natural Denudation describes areas where natural flood events appear to have eliminated all or most of the vegetation identified in the October 2003 Aerial Imagery.

^b Natural Thinning describes areas where natural flood events appear to have substantially reduced the density of the vegetation identified in the October 2003 Aerial Imagery.

^c Human Disturbance describes areas where mechanical processes or new structures appear to have eliminated all or most of the vegetation identified in the October 2003 Aerial Imagery.

^d Undelineated Vegetation Types describes areas of vegetation that were beyond the boundaries of the vegetation classification conducted during the original Meadow Valley Wash Ecological Assessment of 2004 (BIO-WEST 2005). The vegetation was captured in both the original imagery of October 2003 and the subsequent imagery of June 2005. Since no original classification was done in these areas, no specific vegetation typing was possible other than to note all types occur in uplands.

Table 3 delineates the amount of each vegetation type disturbed within Meadow Valley Wash in comparison to the amount of each vegetation type delineated prior to the catastrophic flooding of January 2005. As a result of the catastrophic flood event of January 2005, approximately 19 percent of the pre-flood vegetation has been substantially affected. The riparian communities were most affected with substantial disturbance or loss to approximately 39 percent of the pre-flood vegetation (Table 3). Overall, natural disturbance accounted for approximately 14 percent loss of pre-flood vegetation and human disturbance occurred on approximately 5 percent of what was pre-flood vegetation (Table 3). Human disturbance occurred on approximately 5 percent of both riparian and upland pre-flood vegetation; while natural flood processes affected 34 percent of the pre-flood vegetation in the riparian communities and only 7 percent in the upland communities.

Total acres of seven different vegetation types were reduced by more than 50 percent over pre-flood conditions in Meadow Valley Wash, either by natural flood processes or human disturbance (Table 3). These included Alluvium (316 acres; 60%), Cattail Marsh (22 acres; 61%), Coyote Willow Shrubland (4 acres; 84%), Riparian Forest (144 acres; 70%), Seepwillow Shrubland (14 acres; 81%), Quailbush Shrubland (5 acres; 55%), and Upland Forest (5 acres; 86%). Each of these vegetation types, other than Alluvium and Riparian Forest, are rare within the Meadow Valley Wash and are distinctive dominant communities.

Natural Flooding Changes

Of the approximate 2,095 acres of vegetation change within the Meadow Valley Wash, approximately 1,434 acres (68% of delineated change in Meadow Valley Wash) were described as resulting from natural flood disturbance. This includes approximately 1,077 acres that were denuded of vegetation and approximately 357 acres that were substantially reduced in vegetation density (Table 1 and Table 2). Although most of the natural flood disturbance resulted in a complete denudation of the pre-flood vegetation (1,075 acres), a substantial proportion (25 percent) of the disturbance maintained the pre-flood vegetation type, but significantly reduced the vegetation density (357 acres) (Table 2).

Riparian Vegetation Types

Approximately 58 percent (833 acres) of the vegetation affected by natural flood processes occurred within riparian vegetation types (Table 2). Approximately 545 acres of the riparian vegetation types were denuded of vegetation, or approximately 65 percent of the riparian vegetation delineated as changed by natural flood processes (Table 2). The remaining 35 percent (288 acres) of riparian vegetation affected by natural flood processes were substantially reduced in vegetative density.

Prior to the flood event of January 2005, approximately 2,452 acres of riparian/wetland vegetation types occurred in Meadow Valley Wash (Table 3). Natural flood processes (denudation and thinning) disturbed approximately 34 percent of this pre-flood riparian vegetation (Table 3).

Table 3. Comparison of Post-flood Vegetation – Total Disturbance (July 2005) with Pre-flood Conditions (July 2004) in Meadow Valley Wash.

VEGETATION TYPE / LAND USE	PRE- FLOOD ACRES ^a	NATURAL DISTURBANCE ^b		HUMAN DISTURBANCE ^c		TOTAL DISTURBANCE	
	Acres	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed
RIPARIAN VEGETATION TYPES							
Alluvium	528.43	284.87	53.9%	31.45	6.0%	316.32	59.9%
Arrowweed Shrubland	117.32	46.81	39.9%	2.35	2.0%	49.16	41.9%
Burnt or Dead Tamarisk	251.44	39.59	15.7%	4.75	1.9%	44.34	17.6%
Bush Seepweed Shrubland	45.13	9.82	21.8%	9.78	21.6%	19.60	43.4%
Cattail Marsh	35.49	19.32	54.4%	2.48	7.0%	21.80	61.4%
Coyote Willow Shrubland	4.96	3.78	76.2%	0.38	7.7%	4.16	83.9%
Desert Willow Shrubland	65.71	13.34	20.3%	3.60	5.5%	16.94	25.8%
Fremont Cottonwood Forest	182.29	54.54	29.9%	17.35	9.5%	71.89	39.4%
Mixed Marsh	5.79	0.00	0.0%	0.62	10.7%	0.62	10.7%
Mixed Wet Meadow	119.95	2.75	2.3%	0.02	>0.1%	2.77	2.3%
Open Water	9.86	1.10	11.2%	0.97	9.8%	2.07	21.0%
Red Willow Forest	52.74	15.57	29.5%	0.02	>0.1%	15.59	29.6%
Red Willow Shrubland	7.51	2.73	36.4%	0.05	0.7%	2.78	37.1%
Riparian Forest	204.94	128.44	62.7%	15.13	7.4%	143.57	70.1%
Riparian Forest Tamarisk Woodland Mix	144.05	31.09	21.6%	19.13	13.3%	50.22	34.9%
Saltgrass Grassland	2.43	1.11	45.7%	0.00	0.0%	1.11	45.7%
Seepwillow Shrubland	16.75	10.74	64.1%	2.79	16.7%	13.53	80.8%
Tamarisk Woodland	651.34	167.41	25.7%	22.93	3.5%	190.34	29.2%
Subtotals	2452.14	833.01	34.0%	133.80	5.4%	966.81	39.4%
UPLAND VEGETATION TYPES							
Creosote Bush Shrubland	591.78	49.63	8.4%	25.14	4.2%	74.77	12.6%
Exposed Soil	230.13	0.43	0.2%	0.00	0.0%	0.43	0.2%
Gambel Oak Shrubland	9.33	0.73	7.8%	0.00	0.0%	0.73	7.8%
Greasewood Shrubland	263.44	2.68	1.0%	0.05	>0.1%	2.73	1.0%
Mesquite Shrubland	23.31	0.47	2.0%	0.74	3.2%	1.21	5.2%
Mixed Canyon Shrubland	618.52	74.79	12.1%	38.52	6.2%	113.31	18.3%
Mixed Desert Shrubland	2275.19	182.22	8.0%	175.47	7.7%	357.69	15.7%
Mixed Grassland	211.43	6.58	3.1%	7.70	3.6%	14.28	6.8%

Table 3. Comparison of Post-flood Vegetation – Total Disturbance (July 2005) with Pre-flood Conditions (July 2004) in Meadow Valley Wash (cont.).

VEGETATION TYPE / LAND USE	PRE- FLOOD ACRES ^a	NATURAL DISTURBANCE ^b		HUMAN DISTURBANCE ^c		TOTAL DISTURBANCE	
	Acres	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed
Pasture/Agricultural Lands	989.07	48.79	4.9%	1.91	0.2%	50.70	5.1%
Quailbush Shrubland	8.66	0.05	0.6%	4.73	54.6%	4.78	55.2%
Quarry	235.42	1.39	0.6%	0.19	0.1%	1.58	0.7%
Rabbitbrush Shrubland	350.36	24.05	6.9%	11.83	3.4%	35.88	10.2%
Railroad/Road	241.33	5.73	2.3%	22.57	9.4%	28.30	11.7%
Sagebrush Shrubland	87.37	3.54	4.1%	0.44	0.5%	3.98	4.6%
Shadscale Shrubland	590.74	9.88	1.7%	17.92	3.0%	27.80	4.7%
Sparsely Vegetated/ Disturbed Lands	1104.91	144.55	13.1%	88.33	8.0%	232.88	21.1%
Upland Forest	6.19	5.32	85.9%	0.00	0.0%	5.32	85.9%
Subtotals	7837.18	560.83	7.2%	395.54	5.0%	956.37	12.2%
TOTALS	10289.32	1393.84	13.5%	529.34	5.1%	1923.18	18.7%

^a Pre-flood Acres were the total acres of a vegetation type/land use delineated based on the October 2003 Aerial Imagery and field verified in July 2004 (BIO-WEST 2005).

^b Natural Disturbance includes areas denuded or substantially thinned. These are areas where natural flood events have appeared to have eliminated vegetation or substantially reduced the density of the vegetation identified in the October 2003 Aerial Imagery.

^c Human Disturbance are areas where mechanical processes or new structures appeared to eliminate all or most of the vegetation identified in the October 2003 Aerial Imagery.

A substantial amount (approximately 34%; 285 acres) of the natural disturbance in the riparian communities occurred in the Alluvium vegetation type (Table 2), a type that was sparsely vegetated in pre-flood conditions. Natural flood processes disturbed, primarily through denudation, approximately 54 percent of the pre-flood Alluvium vegetation type (Table 3).

Approximately 20 percent (167 acres) of the natural disturbance in the riparian communities occurred in the Tamarisk Woodland vegetation type, most of which (66%) resulted in a substantial decrease in vegetative density as opposed to total vegetation denudation (Table 2). The natural flood processes disturbed approximately 26 percent of the pre-flood Tamarisk Woodland vegetation type (Table 3).

Within the native riparian vegetation types, most of the natural flood disturbances occurred in the Riparian Forest (15 %) and Fremont Cottonwood Forest (6 %) vegetation types (Table 2). The natural flood processes disturbed approximately 15 percent of the pre-flood Riparian Forest and 30 percent of the pre-flood Fremont Cottonwood Forest (Table 3). Natural thinning of vegetation density in the understories of these two vegetation types accounted for 60 percent (77 acres) and 48 percent (26 acres), respectively, of the natural flood disturbance in these two vegetation types (Table 2).

Natural flood processes disturbed a substantial amount of other pre-flood riparian/wetland vegetation communities as depicted in Table 3. Of particular note is the disturbance of approximately 76 percent of the pre-flood Coyote Willow vegetation type, 64 percent of the pre-flood Seepwillow Shrubland, and 36 percent of the Red Willow Shrubland – all woody vegetation types in limited distribution within the Meadow Valley Wash.

Upland Vegetation Types

Approximately 42 percent (601 acres) of the vegetation affected by natural flood processes occurred within upland vegetation types (Table 2). Much of this disturbance occurred within the general flood plain of Meadow Valley Wash, as delineated in the original Meadow Valley Wash Ecological Baseline Assessment (BIO-WEST 2005). Although approximately 40 acres were affected beyond the boundaries originally classified (Table 2). Approximately 532 acres of the upland vegetation types were denuded of vegetation, or approximately 88 percent of the upland vegetation delineated as changed by natural flood processes (Table 2). The remaining 12 percent (70 acres) of upland vegetation affected by natural flood processes were substantially reduced in vegetative density.

Prior to the flood event of January 2005, approximately 7,837 acres of upland vegetation types occurred in Meadow Valley Wash (Table 3). Natural flood processes (denudation and thinning) disturbed approximately 7 percent of this pre-flood upland vegetation, which is substantially less than the 34 percent of pre-flood riparian vegetation disturbed by natural flood processes (Table 3).

A large amount (approximately 30%; 182 acres) of the natural disturbance in upland communities occurred in the Mixed Desert Shrubland vegetation type (Table 2). Natural flood processes disturbed, primarily through denudation, approximately 8 percent of the pre-flood Mixed Desert Shrubland vegetation type (Table 3).

Other upland vegetation types of possible importance to species covered under the Lincoln County and Clark County MSHCPs were also disturbed by natural flood processes, although not in extensive amounts or as a large proportion of pre-flood vegetation availability. Most of the disturbance occurred in Creosote Bush Shrubland, Mixed Canyon Shrubland, Rabbitbrush Shrubland, and Shadscale Shrubland. A total of approximately 341 acres of these upland vegetation types were disturbed by natural flood processes, which is approximately 8 percent of the pre-flood vegetation within these combined vegetation types.

Approximately 8 percent (50 acres) of the natural flood disturbance in upland communities occurred in Creosote Bush Shrubland (Table 2). This disturbed approximately 8 percent of the pre-flood Creosote Bush Shrublands (Table 3).

Approximately 12 percent (75 acres) of the natural flood disturbance in upland communities occurred in Mixed Canyon Shrubland (Table 2), and disturbed approximately 12 percent of the pre-flood Mixed Canyon Shrublands (Table 3).

Approximately 4 percent (24 acres) of the natural flood disturbance in upland communities occurred in Rabbitbrush Shrubland (Table 2), and disturbed approximately 7 percent of the pre-flood Rabbitbrush Shrublands (Table 3).

Approximately 2 percent (10 acres) of the natural flood disturbance in upland communities occurred in Shadscale Shrubland (Table 2), and disturbed approximately 2 percent of the pre-flood Shadscale Shrublands (Table 3).

Approximately 33 percent (201 acres) of the total natural disturbance in upland communities were delineated in the Sparsely Vegetated/Disturbed Lands vegetation type, Pasture/Agricultural Lands, Quarry, or Railroad/Road right of ways (Table 2).

Human Disturbances

Of the approximate 2,095 acres of vegetation change within the Meadow Valley Wash, human disturbance occurred on approximately 661 acres (32% of delineated change in Meadow Valley Wash) (Table 1 and Table 2). Where human disturbance was delineated, all vegetation was eliminated.

Riparian Vegetation Types

Approximately 20 percent (134 acres) of the total human disturbance occurred within riparian vegetation types (Table 2), and approximately 5 percent of the pre-flood vegetation was eliminated on lands where human disturbance was noted (Table 3). This is in comparison with the approximate 34 percent of pre-flood riparian vegetation disturbed by natural processes.

Human disturbance did not exceed 32 acres of any one vegetation type within the riparian communities. The most human disturbance (approximately 31 acres) was delineated on Alluvium vegetation type (Table 2). Human disturbance was identified on 23 acres of Tamarisk Woodland and 19 acres Riparian Forest Tamarisk Woodland Mix (Table 2), resulting in the loss of 4 percent and 13 percent, respectively, of these pre-flood vegetation types (Table 3). The elimination of the 42 acres of invasive vegetation types provides an opportunity for reestablishment of native vegetation types.

Of the native riparian vegetation types, most of the human disturbance occurred in the Riparian Forest (15 acres) and Fremont Cottonwood Forest (17 acres) (Table 2), which is approximately 2 percent of the pre-flood acreage of each of these two vegetation types (Table 3).

Human disturbance also occurred on riparian/wetland vegetation types with limited distribution in Meadow Valley Wash. Where these disturbances were identified, substantial portions of pre-flood vegetation has been eliminated. These include approximately 22 percent of the pre-flood Bush Seepweed Shrubland, 17 percent of the Seepwillow Shrubland, and 11 percent of the pre-flood Mixed Marsh (Table 3). However, since no records are available immediately after the catastrophic flood, some of these areas could have been initially affected by natural flood processes.

Upland Vegetation Types

Approximately 80 percent (527 acres) of the vegetation on which human disturbance was delineated occurred within upland vegetation types (Table 2). Much of this disturbance occurred within the general flood plain of Meadow Valley Wash, as delineated in the original Meadow Valley Wash Ecological Baseline Assessment (BIO-WEST 2005); although approximately 132 acres were affected beyond the boundaries originally classified, which is substantially more than the 40 acres of natural flood disturbance (Table 2).

Prior to the flood event of January 2005, approximately 7,837 acres of upland vegetation types occurred in Meadow Valley Wash (Table 3). Human disturbance was delineated on approximately 5 percent of this pre-flood upland vegetation (Table 3).

As with natural flood disturbance, a substantial amount (approximately 33%; 175 acres) of the human disturbance delineated in upland communities occurred in the Mixed Desert Shrubland vegetation type (Table 2). Where this human disturbance was identified, approximately 8 percent of the pre-flood Mixed Desert Shrubland vegetation type has been eliminated (Table 3). This is very similar to the resultant loss of Mixed Desert Shrubland vegetation type through natural processes.

Human disturbance was identified on other upland vegetation types of possible importance to species covered under the Lincoln County and Clark County MSHCPs, although not in extensive amounts or as a large proportion of pre-flood vegetation availability. Most of the disturbance occurred in Creosote Bush Shrubland, Mixed Canyon Shrubland, Rabbitbrush Shrubland, and Shadscale Shrubland. A total of approximately 269 acres of human disturbance was identified on these combined upland vegetation types, which is approximately 6 percent of the pre-flood vegetation within these combined vegetation types.

Approximately 5 percent (25 acres) of human disturbance in upland communities occurred in Creosote Bush Shrubland (Table 2). This is approximately 4 percent of the pre-flood Creosote Bush Shrublands (Table 3).

Approximately 7 percent (38 acres) of human disturbance identified in upland communities occurred in Mixed Canyon Shrubland (Table 2), and disturbed approximately 6 percent of the pre-flood Mixed Canyon Shrublands (Table 3).

Approximately 2 percent (12 acres) of human disturbance identified in upland communities occurred in Rabbitbrush Shrubland (Table 2), and disturbed approximately 3 percent of the pre-flood Rabbitbrush Shrublands (Table 3).

Approximately 3 percent (18 acres) of human disturbance identified in upland communities occurred in Shadscale Shrubland (Table 2), and disturbed approximately 3 percent of the pre-flood Shadscale Shrublands (Table 3).

As with natural flood processes, a substantial amount of human disturbance occurred in vegetation types that were previously disturbed. Approximately 21 percent (113 acres) of the human

disturbance delineated occurred in the Sparsely Vegetated/Disturbed Lands vegetation type, Pasture/Agricultural Lands, Quarry, or Railroad/Road right of ways (Table 2 and Table 3).

Types of Human Disturbance

During the site verification, each area with visible human disturbance was described as to the primary type of human disturbance that occurred. Twelve separate types of human disturbance were identified in the field. Table 4 delineates the acres of each type of human disturbance within each vegetation type in Meadow Valley Wash. Mechanical blading and grading occurred over approximately 571 acres. This is approximately 86 percent of the human disturbance in Meadow Valley Wash. The largest extent (154 acres) of the mechanical blading and grading occurred in Mixed Desert Shrubland (Table 4). New road construction was the next most prevalent type of human disturbance (approximately 6%), occurring over approximately 41 acres of previously vegetated land. Widened roads disturbed an additional 15 acres of pre-flood vegetation. New borrow pits occurred on approximately 12 acres of pre-flood vegetation. New stream channels and deflection jetties each occurred on approximately 9 acres of pre-flood vegetation (Table 4). Other noteworthy types of human disturbance include new stream crossings (approximately 2 acres) and new diversion channels (approximately 1 acre) (Table 4).

Clover Creek

Table 5 presents a summary of the delineated post-flood vegetation disturbance described within Clover Creek from Big Springs downstream to the confluence with Meadow Valley Wash. This table describes the type of disturbance identified in July 2005 and the pre-flood vegetation type affected. As can be interpreted from Table 2, current disturbance of pre-flood vegetation appears to be almost equally distributed between natural flood processes (207 acres) and human disturbance (196 acres).

Table 6 delineates the amount of each vegetation type disturbed within Clover Creek in comparison to the amount of each vegetation type delineated prior to the catastrophic flooding of January 2005. As a result of the catastrophic flood event of January 2005, approximately 27 percent of the pre-flood vegetation has been substantially affected, compared with the approximately 19 percent of the pre-flood vegetation substantially affected in Meadow Valley Wash. The riparian communities were most affected with substantial disturbance or loss to approximately 38 percent of the pre-flood vegetation (Table 6), which is similar to the 39 percent of pre-flood riparian vegetation affected in Meadow Valley Wash.

Overall, natural disturbance accounted for approximately 14 percent loss of pre-flood vegetation (Table 6), the same proportion identified in Meadow Valley Wash (Table 3). Human disturbance occurred on approximately 12 percent of what was pre-flood vegetation (Table 6), which is substantially more than the 5 percent of pre-flood vegetation affected by human disturbance in Meadow Valley Wash (Table 3). Both natural flood processes and human activities affected a larger proportion of riparian community types than upland community types in Clover Creek (Table 6).

Table 4. Types and Acres of Human Disturbance in Meadow Valley Wash Delineated in July 2005.

VEGETATION TYPE / LAND USE	TYPES OF DISTURBANCE											
	New Berm	Bladed /Graded	New Borrow Pit	New Bridge	New Diversion	New Jetty	New Channel	New Fence	New Road	New Stream Crossing	Widened Road	Total Human Disturbance
RIPARIAN VEGETATION DISTURBANCE												
	Acres											
Alluvium	-	29.49	-	0.03	0.27	1.37	0.22	-	0.07	-	-	31.45
Arrowweed Shrubland	-	2.34	-	-	-	0.01	-	-	-	-	-	2.35
Burnt or Dead Tamarisk	-	4.15	-	-	-	-	-	0.11	0.07	0.06	0.36	4.75
Bush Seepweed Shrubland	-	9.18	-	-	-	0.36	-	-	0.24	-	-	9.78
Cattail Marsh	-	2.48	-	-	-	-	-	-	-	-	-	2.48
Coyote Willow Shrubland	-	0.38	-	-	-	-	-	-	-	-	-	0.38
Desert Willow Shrubland	-	3.11	0.47	0.02	-	-	-	-	-	-	-	3.60
Fremont Cottonwood Forest	0.16	17.09	-	0.01	-	-	-	-	-	0.09	-	17.35
Mixed Marsh	-	0.62	-	-	-	-	-	-	-	-	-	0.62
Mixed Wet Meadow	-	-	-	0.02	-	-	-	-	-	-	-	0.02
Open Water	-	0.97	-	-	-	-	-	-	-	-	-	0.97
Red Willow Forest	-	-	-	0.02	-	-	-	-	-	-	-	0.02
Red Willow Shrubland	0.05	-	-	-	-	-	-	-	-	-	-	0.05
Riparian Forest	-	14.47	-	0.03	0.03	-	-	-	-	0.60	>0.01	15.13
Riparian Forest Tamarisk Woodland Mix	-	18.14	-	-	-	0.36	-	-	0.63	-	-	19.13
Saltgrass Grassland	-	>0.01	-	-	-	-	-	-	-	-	-	>0.01
Seepwillow Shrubland	-	2.79	-	-	-	-	-	-	-	-	-	2.79
Tamarisk Woodland	-	15.98	-	-	>0.01	0.12	1.07	-	4.01	0.02	1.73	22.93
Subtotals	0.21	121.19	0.47	0.13	0.30	2.22	1.29	0.11	5.02	0.77	2.09	133.80

Table 4. Types and Acres of Human Disturbance in Meadow Valley Wash Delineated in July 2005.

VEGETATION TYPE / LAND USE	TYPES OF DISTURBANCE											
	New Berm	Bladed /Graded	New Borrow Pit	New Bridge	New Diversion	New Jetty	New Channel	New Fence	New Road	New Stream Crossing	Widened Road	Total Human Disturbance
UPLAND VEGETATION TYPES												
Creosote Bush Shrubland	-	16.67	-	-	0.06	-	1.01	-	6.88	0.36	0.16	25.14
Exposed Soil	-	-	-	-	-	-	-	-	-	-	-	0.00
Gambel Oak Shrubland	-	-	-	-	-	-	-	-	-	-	-	0.00
Greasewood Shrubland	0.05	-	-	-	-	-	-	-	-	-	-	0.05
Mesquite Shrubland	-	0.74	-	-	-	-	-	-	-	-	-	0.74
Mixed Canyon Shrubland	-	35.50	0.06	0.03	0.10	1.22	-	-	-	0.38	1.23	38.52
Mixed Desert Shrubland	-	153.90	-	0.02	0.74	4.00	5.93	-	9.08	-	1.80	175.47
Mixed Grassland	-	7.46	-	-	-	0.15	-	-	-	0.09	-	7.70
Pasture/Agricultural Lands	-	1.23	-	-	-	-	-	0.11	0.57	-	-	1.91
Quailbush Shrubland	-	4.35	-	-	-	0.10	-	-	-	-	0.28	4.73
Quarry	-	-	-	-	0.09	-	0.10	-	-	-	-	0.19
Rabbitbrush Shrubland	-	11.48	>0.01	-	-	-	-	-	0.24	0.11	-	11.83
Railroad/Road	-	20.02	0.06	0.31	-	0.16	0.54	-	1.07	0.03	0.38	22.57
Sagebrush Shrubland	-	0.33	0.08	-	-	-	-	-	-	0.03	-	0.44
Shadscale Shrubland	-	16.52	-	-	-	0.06	-	-	0.62	-	0.72	17.92
Sparsely Vegetated/ Disturbed Lands	-	76.36	3.94	>0.01	-	0.79	0.05	0.12	6.36	0.10	0.61	88.33
Upland Forest	-	-	-	-	-	-	-	-	-	-	-	0.00
Subtotals	0.05	344.56	4.14	0.36	0.99	6.48	7.63	0.23	24.82	1.10	5.18	395.54
UNDELINEATED VEGETATION TYPES												
Unknown Upland Vegetation	0.46	104.72	7.16	-	-	0.09	0.02	-	11.08	0.02	7.96	131.51
TOTALS	0.72	570.47	11.77	0.49	1.29	8.79	8.94	0.34	40.92	1.89	15.23	660.85

Table 5. Clover Creek Summary of Post-flood Disturbance (July 2005).

VEGETATION TYPE / LAND USE	NATURAL DENUDATION ^a	NATURAL THINNING ^b	HUMAN DISTURBANCE ^c	TOTAL DISTURBANCE
	Acres	Acres	Acres	Acres
RIPARIAN VEGETATION TYPES				
Alluvium	88.61	0.05	104.57	193.23
Cattail Marsh	1.56	0.00	0.00	1.56
Coyote Willow Shrubland	2.48	0.00	1.29	3.77
Fremont Cottonwood Forest	19.36	0.00	3.82	23.18
Mixed Wet Meadow	7.01	0.00	0.05	7.06
Open Water	3.18	0.00	0.00	3.18
Red Willow Forest	5.55	2.35	7.77	15.67
Water Cress/Duck Weed Marsh	0.50	0.00	0.00	0.50
Subtotals	128.25	2.40	117.50	248.15
UPLAND VEGETATION TYPES				
Mixed Grassland	0.29	0.00	0.00	0.29
Rabbitbrush Shrubland	2.26	0.47	1.73	4.46
Railroad/Road	0.28	0.07	6.09	6.44
Sagebrush Shrubland	22.22	0.55	25.85	48.62
Sparsely Vegetated/ Disturbed Lands	45.60	0.07	19.22	64.89
Subtotals	70.65	1.16	52.89	124.70
UNDELINEATED VEGETATION TYPES^d				
Unknown Upland Vegetation	4.55	0.00	25.45	30.00
TOTALS	203.45	3.56	195.84	402.85

^a Natural Denudation describes areas where natural flood events appear to have eliminated all or most of the vegetation identified in the October 2003 Aerial Imagery.

^b Natural Thinning describes areas where natural flood events appear to have substantially reduced the density of the vegetation identified in the October 2003 Aerial Imagery.

^c Human Disturbance describes areas where mechanical processes or new structures appear to have eliminated all or most of the vegetation identified in the October 2003 Aerial Imagery.

^d Undelineated Vegetation Types describes areas of vegetation that were beyond the boundaries of the vegetation classification conducted during the original Meadow Valley Wash Ecological Assessment of 2004 (BIO-WEST 2005). The vegetation was captured in both the original imagery of October 2003 and the subsequent imagery of June 2005. Since no original classification was done in these areas, no specific vegetation typing was possible other than to note all types occur in uplands.

Table 6. Comparison of Post-flood Vegetation – Total Disturbance (July 2005) with Pre-flood Conditions (July 2004) in Clover Creek.

VEGETATION TYPE / LAND USE	PRE- FLOOD ACRES ^a	NATURAL DISTURBANCE ^b		HUMAN DISTURBANCE ^c		TOTAL DISTURBANCE	
	Acres	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed
RIPARIAN VEGETATION TYPES							
Alluvium	396.80	88.66	22.3%	104.57	26.4%	193.23	48.7%
Cattail Marsh	2.85	1.56	54.7%	0.00	0.0%	1.56	54.7%
Coyote Willow Shrubland	8.40	2.48	29.5%	1.29	15.4%	3.77	44.9%
Fremont Cottonwood Forest	100.08	19.36	19.3%	3.82	3.8%	23.18	23.2%
Mixed Wet Meadow	38.02	7.01	18.4%	0.05	0.1%	7.06	18.6%
Open Water	3.35	3.18	94.9%	0.00	0.0%	3.18	94.9%
Red Willow Forest	95.87	7.90	8.2%	7.77	8.1%	15.67	16.3%
Water Cress/ Duck Weed Marsh	0.72	0.50	69.4%	0.00	0.0%	0.50	69.4%
Subtotals	646.09	130.65	20.2%	117.50	18.2%	248.15	38.4%
UPLAND VEGETATION TYPES							
Gambel Oak Shrubland	0.59	0.00	0.0%	0.00	0.0%	0.00	0.0%
Mixed Grassland	18.41	0.29	1.6%	0.00	0.0%	0.29	1.6%
Rabbitbrush Shrubland	73.13	2.73	3.7%	1.73	2.4%	4.46	6.1%
Railroad/Road	80.81	0.35	0.4%	6.09	7.5%	6.44	8.0%
Sagebrush Shrubland	266.20	22.77	8.6%	25.85	9.7%	48.62	18.3%
Sparsely Vegetated/ Disturbed Lands	318.74	45.67	14.3%	19.22	6.0%	64.89	20.3%
Subtotals	757.88	71.81	9.5%	52.89	7.0%	124.70	16.5%
TOTALS	1403.97	202.46	14.4%	170.39	12.1%	372.85	26.5%

^a Pre-flood Acres were the total acres of a vegetation type/land use delineated based on the October 2003 Aerial Imagery and field verified in July 2004 (BIO-WEST 2005).

^b Natural Disturbance includes areas denuded or substantially thinned. These are areas where natural flood events have appeared to have eliminated vegetation or substantially reduced the density of the vegetation identified in the October 2003 Aerial Imagery.

^c Human Disturbance are areas where mechanical processes or new structures appeared to eliminate all or most of the vegetation identified in the October 2003 Aerial Imagery.

Total acres of three different vegetation types were reduced by more than 50 percent over pre-flood conditions in Clover Creek, either by natural flood processes or human disturbance (Table 6). These included Cattail Marsh (2 acres; 55%), Water Cress/Duck Weed Marsh (0.5 acres; 69%), and Open Water (3 acres; 95%). Open water may be influenced by temporal factors and recent climactic events at the time of imagery acquisition, and may not be a conclusive category for evaluation. The other two vegetation types are very limited in Clover Creek as distinctive dominant communities. Additionally, 45 percent of the approximate 8 acres of pre-flood Coyote Willow Shrubland was

changed by the catastrophic flood (Table 6). As with Meadow Valley Wash, most of the changes (193 acres) occurred in the Alluvium vegetation type – the most common type in Clover Creek.

Natural Flooding Changes

Of the approximate 403 acres of vegetation change within Clover Creek, approximately 207 acres (51% of delineated change in Clover Creek) were described as resulting from natural flood disturbance. The vast majority (98%) of the natural flood disturbance were denuded of vegetation (Table 5). This contrasts to Meadow Valley Wash where a substantial proportion (25 percent) of the natural flood disturbance still maintained the pre-flood vegetation type, although the vegetation density was significantly reduced (Table 2).

Riparian Vegetation Types

Approximately 63 percent (131 acres) of the vegetation affected by natural flood processes (207 acres) occurred within riparian vegetation types (Table 5). Approximately 128 acres of the riparian vegetation types were denuded of vegetation, while only about 2 acres of riparian vegetation were substantially reduced in vegetative density (Table 5).

Prior to the flood event of January 2005, approximately 646 acres of riparian/wetland vegetation types occurred in Clover Creek from Big Creek downstream to the confluence with Meadow Valley Wash at Caliente (Table 6). Natural flood processes (denudation and thinning) disturbed approximately 20 percent of this pre-flood riparian vegetation (Table 6).

Most (68%; 89 acres) of the natural disturbance in the riparian communities occurred in the Alluvium vegetation type (Table 5), a type that was sparsely vegetated in pre-flood conditions. Natural flood processes disturbed, primarily through denudation, approximately 22 percent of the pre-flood Alluvium vegetation type in Clover Creek (Table 6).

Within the native riparian vegetation types, most of the natural flood disturbances occurred in the Fremont Cottonwood Forest (14%; 19 acres) (Table 5). The natural flood processes eliminated approximately 19 percent of the pre-flood Fremont Cottonwood Forest (Table 6). Natural flood processes also eliminated a substantial portion (30%) of the pre-flood Coyote Willow Shrubland, a riparian woody vegetation type with very limited distribution in Clover Creek (Table 6).

Upland Vegetation Types

Approximately 37 percent (76 acres) of the vegetation affected by natural flood processes occurred within upland vegetation types (Table 5). Much of this disturbance occurred within the general flood plain of Clover Creek, although approximately 5 acres were affected beyond the boundaries of image classification conducted in the original vegetation baseline study (BIO-WEST 2005). Approximately 75 acres of the upland vegetation types were denuded of vegetation, while only about 1 acre of upland vegetation was substantially reduced in vegetative density (Table 5).

Prior to the flood event of January 2005, approximately 758 acres of upland vegetation types occurred in Clover Creek (Table 6). Natural flood processes (denudation and thinning) disturbed

approximately 10 percent of this pre-flood upland vegetation (Table 6). None of the vegetation types were substantially reduced by natural flood processes.

Sagebrush Shrubland was the native upland vegetation community most affected by natural flood processes, and only to the extent of 23 acres of disturbance or approximately 9 percent of pre-flood Sagebrush Shrubland in Clover Creek.

Approximately 60 percent (46 acres) of the total natural disturbance in upland communities were delineated in the Sparsely Vegetated/Disturbed Lands vegetation type and Railroad/Road right of ways (Table 5).

Human Disturbances

Of the approximate 403 acres of vegetation change within Clover Creek, human disturbance occurred on approximately 196 acres (49% of delineated change in Clover Creek) (Table 1 and Table 5). Where human disturbance was delineated, all vegetation was eliminated. The proportionate amount of human disturbance in relation to total disturbance in Clover Creek is substantially higher than in Meadow Valley Wash – 49 percent to 32 percent, respectively.

Riparian Vegetation Types

Approximately 60 percent (118 acres) of the vegetation on which human disturbance was delineated occurred within riparian vegetation types (Table 5). Human disturbance occurred on approximately 47 percent of all the flood disturbed riparian vegetation in Clover Creek (Table 5). Comparatively, human disturbance only occurred on approximately 14 percent of all the flood disturbed riparian vegetation in Meadow Valley Wash (Table 2). Total acres of riparian vegetation on which human disturbance was delineated in Clover Creek was similar to the total acres of riparian vegetation on which human disturbance was delineated in Meadow Valley Wash (118 acres and 134 acres, respectively). In relation to linear mile of stream corridor, human disturbance occurred on riparian vegetation types in Meadow Valley Wash at 1.6 acres per linear mile, while human disturbance occurred on riparian vegetation types in Clover Creek at 8.4 acres per linear mile. These relationships indicate that, proportionately, more human disturbance was delineated in the riparian vegetation types of Clover Creek than the riparian vegetation types of Meadow Valley Wash.

Approximately 18 percent of the pre-flood riparian vegetation was eliminated on lands where human disturbance was noted (Table 6). This is in comparison with the approximate 20 percent of pre-flood vegetation altered by natural processes. In Meadow Valley Wash, 5 percent of the pre-flood riparian vegetation was eliminated on lands where human disturbance was noted (Table 3).

The most human disturbance (approximately 105 acres) was delineated on Alluvium vegetation type (Table 5). This accounts for approximately 89 percent of all riparian vegetation types on which human disturbance were noted in Clover Creek. Most (about 13 acres) of the remaining human disturbance occurred on native woody riparian vegetation types including Coyote Willow Shrubland (1 acre), Fremont Cottonwood Forest (4 acres), and Red Willow Forest (8 acres) (Table 5). In total, human disturbance occurred on approximately 6 percent of the pre-flood woody riparian vegetation

types in Clover Creek. This is similar to the approximate 5 percent of pre-flood woody riparian vegetation types in Meadow Valley Wash on which human disturbance occurred.

It is interesting to note that approximately 5 acres of new marsh appears to have been created in Clover Creek between the existing railroad bed and the newly graded and built-up access road at approximately 6.8 miles upstream from the confluence of Clover Creek with Meadow Valley Wash (see Sheet 69 of the Atlas). Pre-flood sparsely vegetated lands and shrublands appear to have been inundated and converted to shallow water/emergent wetland vegetation. From the aerial imagery it appears that a spring drainage between the railroad and the road may have been blocked, resulting in ponding within the enclosed area. Subsequent to this inundation, it appears the original drainage was reopened and a diversion channel established to drain this newly inundated area. As such, it is not anticipated that a marsh vegetation type of this extent will be perpetuated at this location.

Upland Vegetation Types

Approximately 40 percent (78 acres) of the vegetation on which human disturbance was delineated in Clover Creek occurred within upland vegetation types (Table 5). Much of this disturbance occurred within the general flood plain of Clover Creek, as delineated in the original Meadow Valley Wash Ecological Baseline Assessment (BIO-WEST 2005). Although approximately 5 acres were affected beyond the boundaries originally classified. In comparison, approximately 66 percent of the vegetation on which human disturbance was delineated in Meadow Valley Wash occurred within upland vegetation types (Table 2).

Prior to the flood event of January 2005, approximately 758 acres of upland vegetation types occurred in Clover Creek (Table 6). Human disturbance was delineated on approximately 7 percent (53 acres) of this pre-flood upland vegetation (Table 6).

As with natural flood disturbance, a substantial amount (approximately 49%; 25 acres) of the human disturbance in upland communities occurred in the Sagebrush Shrubland vegetation type (Table 5). Where this human disturbance was identified, approximately 10 percent of the pre-flood Sagebrush Shrubland vegetation type has been eliminated (Table 3). This is very similar to the resultant loss of Sagebrush Shrubland vegetation type through natural processes (23 acres).

The only other native upland community in Clover Creek affected by human disturbance was approximately 2 acres of Rabbitbrush Shrubland that eliminated approximately 2 percent of the pre-flood community.

A substantial amount of human disturbance occurred in vegetation types that were previously disturbed. Approximately 47 percent (32 acres) of the delineated human disturbance occurred in the Sparsely Vegetated/Disturbed Lands vegetation type and Railroad/Road right of ways (Table 5).

Table 7. Types and Acres of Human Disturbance in Clover Creek Delineated in July 2005.

VEGETATION TYPE / LAND USE	TYPES OF DISTURBANCE											
	New Berm	Bladed / Graded	New Borrow Pit	New Bridge	New Diversion	New Jetty	New Channel	New Fence	New Road	New Stream Crossing	Widened Road	Total Human Disturbance
RIPARIAN VEGETATION DISTURBANCE												
	Acres											
Alluvium	2.19	96.80	-	-	0.15	3.06	1.42	-	-	-	0.95	104.57
Coyote Willow Shrubland	0.19	1.01	-	-	0.01	-	0.08	-	-	-	-	1.29
Fremont Cottonwood Forest	-	3.02	-	-	-	>0.01	0.63	-	-	-	0.17	3.82
Mixed Wet Meadow	-	0.05	-	-	-	-	-	-	-	-	-	0.05
Red Willow Forest	-	7.26	-	0.01	-	-	-	-	-	-	0.50	7.77
Subtotals	2.38	108.14	0.00	0.01	0.16	3.06	2.13	0.00	0.00	0.00	1.62	117.50
UPLAND VEGETATION TYPES												
Mixed Grassland	-	-	-	-	-	-	-	-	-	-	-	0.00
Rabbitbrush Shrubland	-	1.60	-	-	-	-	-	-	-	-	0.13	1.73
Railroad/Road	-	4.95	-	0.02	>0.01	0.52	-	-	-	-	0.60	6.09
Sagebrush Shrubland	0.45	21.98	-	-	0.01	2.76	0.22	-	-	-	0.43	25.85
Sparsely Vegetated/ Disturbed Lands	-	19.05	-	-	-	0.01	-	-	-	-	0.16	19.22
Subtotals	0.45	47.58	0.00	0.02	0.01	3.29	0.22	0.00	0.00	0.00	1.32	52.89
UNDELINEATED VEGETATION TYPES												
Unknown Upland Vegetation	-	24.89	-	-	-	-	-	-	-	-	0.56	25.45
TOTALS	2.83	180.61	0.00	0.03	0.17	6.35	2.35	0.00	0.00	0.00	3.50	195.84

Types of Human Disturbance

During the site verification, each area in with visible human disturbance was described as to the primary type of human disturbance that was done. Twelve separate types of human disturbance were identified in the field. Table 7 delineates the acres of each type of human disturbance within each vegetation type in Clover Creek. As with Meadow Valley Wash, mechanical blading and grading accounted for the vast majority of human disturbance. Mechanical blading and grading occurred over approximately 181 acres in Clover Creek. This is approximately 92 percent of the human disturbance in Clover Creek. The largest extent (97 acres) of the mechanical blading and grading occurred in Alluvium (Table 7). New deflection jetty construction was the next most prevalent type of human disturbance (approximately 3%) occurring over approximately 6 acres of previously vegetated land. The deflection jetties occur along one segment of the railroad and appears to have been developed to protect the railroad bed from future flood erosion and scouring. Widened roads disturbed an additional 4 acres of pre-flood vegetation. New berms and newly created stream channels occurred on approximately 3 acres and 2 acres, respectively, of pre-flood vegetation (Table 7).

Post-flood Southwestern Willow Flycatcher Habitat Changes

Southwestern willow flycatcher (SWWFC) habitat was delineated for Meadow Valley Wash as an integral component of the original Meadow Valley Wash Baseline Ecological Assessment conducted in 2004 (BIO-WEST 2005). This delineation is representative of conditions prior to the January 11, 2005, catastrophic flood and is described as pre-flood SWWFC habitat in this current report. A limitation of the baseline ecological evaluation was that no habitat delineations were made for Clover Creek. As such, post-flood changes in SWWFC habitat can only be described for Meadow Valley Wash. SWWFC habitat in Meadow Valley Wash was defined as suitable habitat or potential habitat.

SWWFC Suitable Habitat was defined as woody riparian vegetation stands, either trees or shrubs, that appear to have all the components necessary for SWWFC to establish territories and/or nest. Woody riparian vegetation may be dominated by native vegetation or by exotic tamarisk. The primary components include: (1) a stand, or patch size, of 0.25 acre or greater; (2) a vegetation width of more than about 30 feet; (3) a dense canopy; (4) dense interior vegetation from ground level up to about 15 feet or dense patches interspersed with openings; and (5) surface water or saturated soils present within the stand or within 125 feet of the stand. Suitable habitat may be unoccupied for any of a multitude of reasons (BIO-WEST 2005). This definition is consistent with the suitable habitat definition in the SWWFC Recovery Plan (USFWS 2002).

SWWFC Potential Habitat was defined as woody riparian vegetation stands that do not currently have all the components necessary for SWWFC to establish territories and/or reproduce but do have the vegetation composition, patch size, and the basic vegetation structure to potentially develop into SWWFC Suitable Habitat in the future, especially if management objectives are designed to promote suitable habitat development (BIO-WEST 2005). This definition is consistent with the potential habitat definition in the SWWFC Recovery Plan (USFWS 2002).

Approximately 1,406 acres of SWWFC habitat (suitable and potential combined) occurred in Meadow Valley Wash prior to the January 11, 2005, flood. A total of approximately 507 acres of SWWFC habitat was delineated as changed from pre-flood conditions, which is a loss of approximately 36 percent of the total pre-flood SWWFC habitat in Meadow Valley Wash (Table 8). Natural flooding has caused the loss the vast majority (86%) of the total SWWFC habitat; while human disturbance occurred on only 14 percent (73 acres) of pre-flood SWWFC habitat (Table 8).

Southwestern Willow Flycatcher Suitable Habitat Loss

Most (64%) of the SWWFC habitat that was lost after the January 11, 2005 flood was delineated as suitable habitat. A total of approximately 326 acres of SWWFC Suitable Habitat was changed from pre-flood conditions (Table 8). This is approximately 46 percent of the pre-flood SWWFC Suitable Habitat in Meadow Valley Wash (Table 8).

Natural Flooding Changes

Natural flooding has caused the loss of approximately 274 acres of SWWFC Suitable Habitat in Meadow Valley Wash. This is the vast majority (84%) of the total SWWFC Suitable Habitat lost in Meadow Valley Wash (Table 8). Approximately 98 acres were entirely denuded, while 176 acres were substantially reduced in vegetation density, particularly the understory components necessary for SWWFC nesting. Substantial thinning and vegetation density reduction has eliminated the SWWFC Suitable Habitat; however, environmental site conditions may still be conducive to re-establishment of vegetative densities required for SWWFC habitat. An analysis of such re-establishment is beyond the scope of this study.

Natural flooding affected approximately 126 acres of native vegetation types supporting pre-flood SWWFC Suitable Habitat, resulting in the loss of approximately 56 percent of the pre-flood SWWFC Suitable Habitat in native vegetation types. Most of this loss (96 acres) occurred in Riparian Forest where 67 percent of the pre-flood SWWFC Suitable Habitat was lost (Table 8). Approximately 38 acres of the Riparian Forest was denuded and approximately 58 acres were substantially reduced in vegetation density.

Suitable habitat in Fremont Cottonwood Forest was also substantially affected with the loss of 20 acres of habitat, which is approximately 41 percent of the pre-flood SWWFC habitat in Fremont Cottonwood Forest. Approximately 5 acres of the Fremont Cottonwood Forest delineated as SWWFC Suitable Habitat was denuded, while 15 acres were substantially reduced in vegetation density.

Natural flood processes eliminated a substantial amount of other pre-flood SWWFC Suitable Habitat in native vegetation types. Of particular note is the disturbance of approximately 67 percent of the pre-flood suitable habitat in Desert Willow Shrubland, and 93 percent of the pre-flood suitable habitat in Red Willow Shrubland – both woody vegetation types with extremely limited suitable habitat and distribution within the Meadow Valley Wash.

Table 8. Comparison of Post-flood Southwestern Willow Flycatcher Habitat with Pre-flood Conditions (July 2004) in Meadow Valley Wash.

VEGETATION TYPE / LAND USE	PRE-FLOOD ACRES ¹	NATURAL DISTURBANCE ²		HUMAN DISTURBANCE ³		TOTAL DISTURBANCE	
	Acres	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed	Acres Disturbed	Percent Disturbed
SUITABLE HABITAT FOR SOUTHWESTERN WILLOW FLYCATCHER							
Desert Willow Shrubland	0.56	0.38	67.8%	0.00	0.0%	0.38	67.8%
Fremont Cottonwood Forest	48.29	19.72	40.8%	8.60	17.8%	28.32	58.6%
Red Willow Forest	30.41	8.01	26.3%	0.02	0.1%	8.03	26.4%
Red Willow Shrubland	1.67	1.55	92.8%	0.00	0.0%	1.55	92.8%
Riparian Forest	142.84	96.12	67.3%	11.19	7.8%	107.31	75.1%
Riparian Forest Tamarisk Woodland Mix	133.26	28.62	21.5%	18.66	14.0%	47.28	35.5%
Tamarisk Woodland	355.62	120.08	33.8%	13.07	3.7%	133.15	37.4%
Subtotals	713.65	274.48	38.5%	51.54	7.2%	326.02	45.7%
POTENTIAL HABITAT FOR SOUTHWESTERN WILLOW FLYCATCHER							
Burnt or Dead Tamarisk Woodland	245.72	36.92	15.0%	2.34	1.0%	39.26	16.1%
Coyote Willow Shrubland	4.96	3.78	76.2%	0.38	7.7%	4.16	83.9%
Desert Willow Shrubland	19.83	5.77	29.1%	0.27	1.4%	6.04	30.5%
Freemont Cottonwood Forest	74.54	19.49	26.1%	7.39	9.9%	26.88	36.1%
Red Willow Forest	16.93	7.56	44.7%	0.00	0.0%	7.56	44.7%
Red Willow Shrubland	5.84	1.17	20.0%	0.05	0.9%	1.22	20.9%
Riparian Forest	62.12	32.31	52.0%	3.94	6.3%	36.25	58.3%
Riparian Forest Tamarisk Woodland Mix	10.78	2.46	22.8%	0.46	4.3%	2.92	27.1%
Seep Willow Shrubland	13.51	7.77	57.5%	2.79	20.7%	10.56	78.2%
Tamarisk Woodland	238.05	41.69	17.5%	4.16	1.7%	45.85	19.3%
Subtotals	692.28	158.92	23.0%	21.78	3.1%	180.70	26.1%
TOTALS	1405.93	433.40	30.8%	73.32	5.2%	506.72	36.0%

^a Pre-flood Acres were the acres of a Southwestern Willow Flycatcher habitat delineated in the original Meadow Valley Wash Baseline Ecological Assessment (BIO-WEST 2005).

^b Natural Disturbance includes areas denuded or substantially thinned. These are areas where natural flood events have appeared to have eliminated vegetation or substantially reduced the density of the vegetation identified in the October 2003 Aerial Imagery.

^c Human Disturbance are areas where mechanical processes or new structures appeared to eliminate all or most of the vegetation identified in the October 2003 Aerial Imagery.

Most of the SWWFC Suitable Habitat loss resulting from natural flood events occurred in Tamarisk Woodland. Approximately 120 acres of Tamarisk Woodland suitable habitat were eliminated, which is approximately 34 percent of the pre-flood suitable habitat delineated in Tamarisk Woodland. Again most of the suitable habitat loss in this vegetation type was the result of a substantial reduction in vegetation density (83 acres).

Human Disturbance

Human disturbance was delineated on approximately 52 acres of pre-flood SWWFC Suitable Habitat in Meadow Valley Wash. This 52 acres comprises approximately 16 percent of the total SWWFC Suitable Habitat lost in Meadow Valley Wash (Table 8). Where the human disturbance was delineated, all vegetation was eliminated and no SWWFC habitat remained.

Most (62%) of the human disturbance delineated on pre-flood SWWFC Suitable Habitat occurred on invasive vegetation types including Tamarisk Woodland (13 acres) and Riparian Forest Tamarisk Woodland Mix vegetation types (19 acres).

Human disturbance was delineated on approximately 20 acres of native vegetation types supporting pre-flood SWWFC Suitable Habitat, resulting in the loss of approximately 9 percent of the pre-flood SWWFC Suitable Habitat. Human disturbance primarily occurred on pre-flood SWWFC Suitable Habitat in Riparian Forest vegetation type (11 acres) and Fremont Cottonwood Forest (9 acres).

Southwestern Willow Flycatcher Potential Habitat Loss

Approximately 36 percent of the SWWFC habitat that was lost after the January 11, 2005 flood was delineated as potential habitat. A total of approximately 181 acres of SWWFC Potential Habitat was changed from pre-flood conditions, which is approximately 26 percent of the pre-flood SWWFC Potential Habitat in Meadow Valley Wash (Table 8).

Natural Flooding Changes

Natural flooding has caused the loss of approximately 159 acres of SWWFC Potential Habitat in Meadow Valley Wash. Natural flooding comprised the vast majority (88%) of the total SWWFC Potential Habitat lost in Meadow Valley Wash (Table 8). Approximately 68 acres were entirely denuded, while 91 acres were substantially reduced in vegetation density, particularly the understory components necessary for SWWFC nesting. As with SWWF Suitable Habitat, substantial thinning and vegetation density reduction has eliminated the SWWFC Potential Habitat; however, environmental site conditions may still be conducive to re-establishment of vegetative densities required for SWWFC habitat. An analysis of such re-establishment is beyond the scope of this study.

Natural flooding affected approximately 78 acres of native vegetation types supporting pre-flood SWWFC Potential Habitat, resulting in the loss of approximately 39 percent of the pre-flood SWWFC Potential Habitat in native vegetation types. A substantial amount (32 acres) of this loss occurred in Riparian Forest where 52 percent of the pre-flood SWWFC Potential Habitat was lost

(Table 8). Approximately 13 acres of the Riparian Forest was denuded and approximately 19 acres were substantially reduced in vegetation density.

Potential habitat in Freemont Cottonwood Forest was also substantially affected with the loss of approximately 19 acres of habitat, which is approximately 26 percent of the pre-flood SWWFC Potential Habitat in Freemont Cottonwood Forest. Whereas in most instances, SWWFC habitat was lost due to a substantial reduction in vegetation density as opposed to complete loss of vegetation, loss of SWWFC Potential Habitat in Freemont Cottonwood was primarily denudation: approximately 13 acres of the Freemont Cottonwood Forest delineated as SWWFC Potential Habitat was denuded, while about 6 acres were substantially reduced in vegetation density.

Approximately 50 percent (79 acres) of SWWFC Potential Habitat loss resulting from natural flood events occurred in Tamarisk Woodland or Burnt Tamarisk Woodland. The loss of 79 acres of these vegetation types, eliminated approximately 16 percent of the pre-flood potential habitat delineated in Tamarisk Woodland and Burnt Tamarisk Woodland. Most of the potential habitat loss in this vegetation type was the result of a substantial reduction in vegetation density (55 acres).

Human Disturbance

Human disturbance was delineated on approximately 22 acres of pre-flood SWWFC Potential Habitat in Meadow Valley Wash. This 22 acres comprises approximately 12 percent of the total SWWFC Potential Habitat lost in Meadow Valley Wash (Table 8). Where the human disturbance was delineated, all vegetation was eliminated and no SWWFC habitat remained.

Human disturbance was delineated on approximately 15 acres of native vegetation types supporting pre-flood SWWFC Potential Habitat, resulting in the loss of approximately 8 percent of the pre-flood SWWFC Potential Habitat. Human disturbance primarily occurred on pre-flood SWWFC Potential Habitat in Freemont Cottonwood Forest (7 acres), Riparian Forest (4 acres), and Seep Willow Shrubland (3 acres).

Approximately 7 acres of the human disturbance delineated on pre-flood SWWFC Potential Habitat occurred on invasive vegetation types including Tamarisk Woodland (4 acres) and Burnt Tamarisk Woodland (2 acres).

REFERENCES

- Averett W.R. 1995. Through the Rainbow Canyon. Grand Junction (CO): Walter R. Averett. 176 p.
- [BIO-WEST] BIO-WEST, Inc. 2005. Meadow Valley Wash final baseline ecological assessment. Pioche (NV): Lincoln County. 105 p. plus appendices.
- Clark County. 2000. Final Clark County multiple species habitat conservation plan and environmental impact statement for issuance of a permit to allow incidental take of 79 species in Clark County, Nevada. Las Vegas: Clark County Department of Comprehensive Planning, and Reno (NV): U.S. Fish and Wildlife Service. 528 p. plus appendices.
- Lincoln County. 2003. Multiple-species habitat conservation plan for Southeastern Lincoln County, Nevada. Pioche (NV): Lincoln County Commission. 109 p. plus appendices.
- Provencher L., Nachlinger J., Forbis T., Morrill W.M. 2003. Antelope and North Springs Valleys, Steptoe Valley and uplands, Newark Valley extended watershed, and Meadow Valley Wash and uplands conservation area assessment executive summary. Revised final draft. Reno: The Nature Conservancy. 79 p.
- USFWS. 2002. Southwestern willow flycatcher recovery plan. Albuquerque (NM): U.S. Fish and Wildlife Service. 210 p. plus appendices.

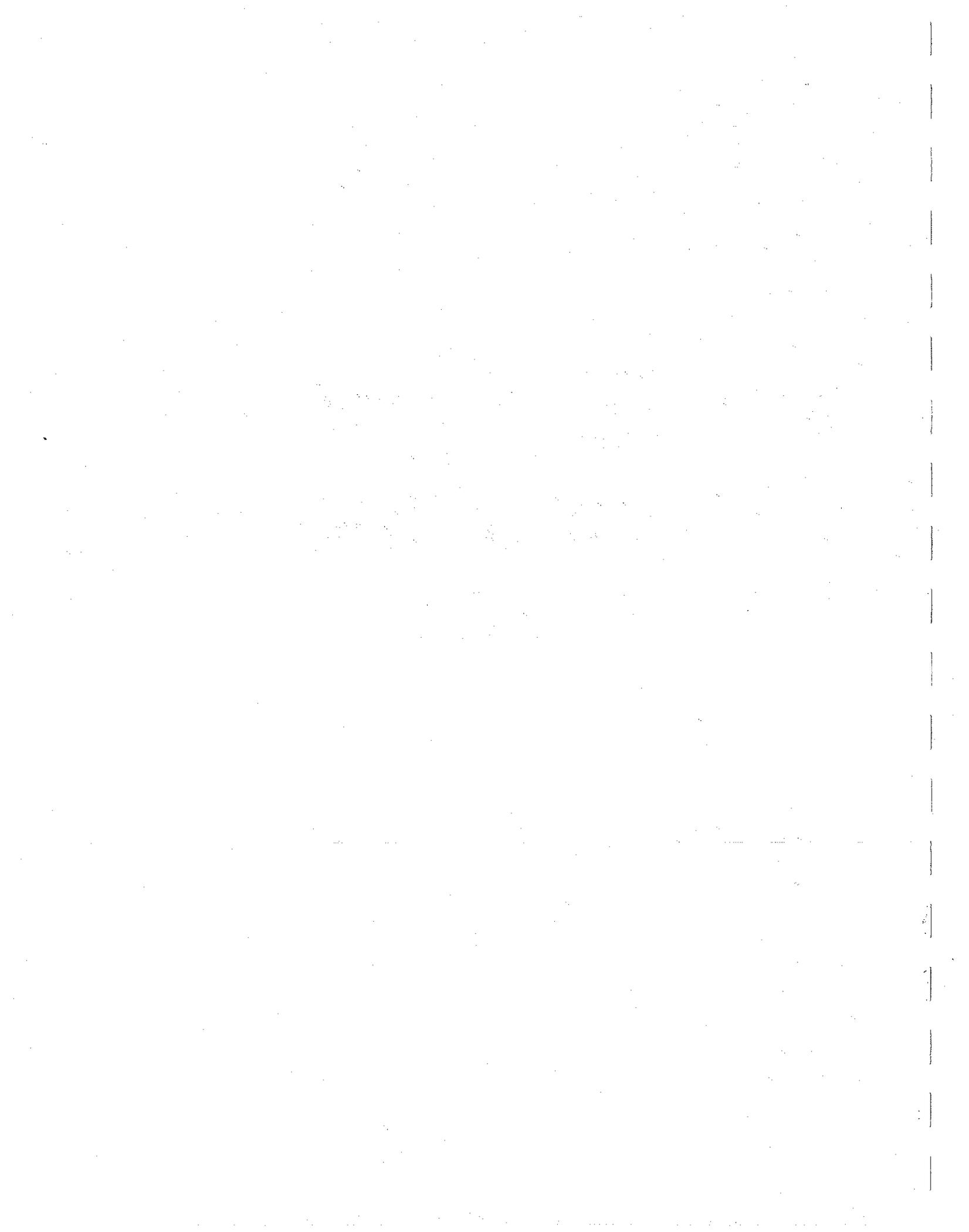
Clark County Drainage Design Manual Excerpts

**CLARK COUNTY REGIONAL
FLOOD CONTROL DISTRICT**

**HYDROLOGIC CRITERIA AND
DRAINAGE DESIGN MANUAL**

ADOPTED

AUGUST 12, 1999



General Index

AMENDMENTS AND REVISIONS

ACKNOWLEDGMENTS

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Amendments and Revisions

This MANUAL has been prepared using current, state-of-the-art technology and procedures. Due to the dynamic nature of urban storm drainage, amendments and revisions will be required from time to time as the state-of-the-art changes and experience is gained in the use of this MANUAL.

Users of this MANUAL are encouraged to submit their comments and revisions. This information should be addressed to:

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General Manager/Chief Engineer
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600 South Grand Central Parkway
Suite 300
Las Vegas, Nevada 89106-4511

Comments and revisions may also be faxed to (702) 455-3870. For information purposes, the CCRFCD maintains a website at: <http://www.ccrfcd.org/>.

A list of MANUAL holders will be maintained by the CCRFCD. To receive copies of amendments or revisions, please complete the form below and submit it to the address shown.

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Re: Hydrologic Criteria and Drainage Design Manual

NAME: _____

COMPANY: _____

MAILING ADDRESS

DATE MANUAL RECEIVED: _____

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Section 1500

Structural Best Management Practices

1501 INTRODUCTION

This document presents design criteria for structural Best Management Practices (BMPs) for control of surface water quality in Las Vegas Valley. These BMPs have been identified as having potential effectiveness in Las Vegas Valley based on the types of water quality conditions expected in this area, and on documented BMP performance in other areas. Criteria for the following BMPs are presented:

- Infiltration Basin
- Infiltration Trench
- Porous Pavement
- First Flush Diversion System
- Dry Extended Detention Pond
- Vegetated Swale
- Water Quality Inlet

The BMP design criteria presented in this report are offered only as suggestions at this time. There are currently no federal, state or local regulations which require the installation of specific facilities in new or existing developments in Las Vegas Valley. *Thus these BMPs should be viewed as suggestions, not as requirements, for mitigating the impacts of urban development on surface water resources in Las Vegas Valley.*

There are three general categories of conditions for which urban stormwater quality management practices may have to be applied: (1) existing urban development; (2) new urban development; and (3) construction activity. The BMPs in this document are primarily applicable to areas of new urban development, where land is available to devote to installations of this type and where design flexibility exists. In certain cases, these structural BMPs may be effective in retrofitting existing developed areas to control water quality problems. However, it is generally more cost-effective to rely on nonstructural BMPs (e.g., source controls, housekeeping practices, public education, employee training) in these applications. BMPs related to construction activity are primarily directed toward erosion control. This issue is covered separately in the Clark County Regional Flood Control District's "Hydrologic Criteria and Drainage Design Manual" and "Uniform Regulations for the Control of Drainage".

The design criteria presented below provide general guidelines for design of the selected structural BMPs. They do not represent detailed plans or specifications for the improvements. The information presented herein is intended to assist the designer in selecting the best BMP for a particular application. For each BMP the following information is provided:

Description of Facility (including schematic drawing)
Water Quality Benefits
Design Criteria
Maintenance

If more detailed design information is desired for the structural BMPs discussed in this report and others which are utilized throughout the country, reference may be made to the following documents:

Storm Water Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices, United States Environmental Protection Agency, Office of Wastewater Enforcement and Compliance, July 1992.

Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices, United States Environmental Protection Agency, Office of Wastewater Enforcement and Compliance, July 1992.

Manual of Standards for the New Development Management Program, County of Sacramento, November 1990 (Draft).

Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs, Metropolitan Washington Council of Governments, July 1987.

Protecting Water Quality in Urban Areas, Best Management Practices for Minnesota, Minnesota Pollution Control Agency, October 1989.

Storm water Management Manual for the Puget Sound Basin, Washington State Department of Ecology, June 1991 (Draft).

Cost of Urban Nonpoint Source Water Pollution Control Measures, Southeastern Wisconsin Regional Planning Commission, June 1991.

1502 INFILTRATION BASIN

1502.1 Description of Facility

Infiltration basins are natural or open excavated depressions of varying size in the ground surface for storage and infiltration of storm water. These basins are effective where soils are very permeable to support infiltration. The purpose of the basin is to temporarily store the surface runoff for a selected design storm or runoff volume and to maintain or increase ground water infiltration through the bottom and sides of the basin. **Figure 1501** presents a schematic plan for an infiltration basin.

1502.2 Water Quality Benefits

Properly constructed infiltration basins have a moderate to high removal capability for both soluble and small particulate pollutants associated with urban runoff. Stored runoff percolates through the soil layer, where a number of physical, chemical and biological removal processes occur. Infiltration removal efficiency depends on the amount of annual runoff volume effectively exfiltrated through the soil layer. Removal rates can be enhanced by maximizing the surface area available for exfiltration, and by limiting the draining time to avoid uncontrolled overflows due to back-to-back storms. Estimated long-term removal rates for infiltration basins are given below.

<u>Pollutant</u>	<u>Range of Long-Term Removal Efficiency</u>
Sediment	75 - 99%
Total Phosphorus	50 - 75%
Total Nitrogen	45 - 70%
Trace Metals	75 - 99%
BOD	70 - 90%
Bacteria	75 - 98%

Among the BMPs considered herein, infiltration basins most closely reproduce natural, predevelopment hydrologic conditions. Other benefits include reduction in downstream peak flows and runoff volumes, ground water recharge, low flow augmentation, and reduced downstream erosion potential.

1502.3 Design Criteria

- A minimum of 4 feet should be provided below the bottom of the basin to bedrock or the water table.
- Locate facilities a minimum of 100 feet upslope and 20 feet downslope from any building.
- Infiltration basins are not recommended for developments which have extensive cut and fill areas.
- The minimum infiltration rate allowable for design is 0.3 inches/hour. A safety factor of 2.0 should be applied to the actual infiltration rate for facility sizing.
- Infiltration basins are generally utilized for small areas. The maximum allowable drainage area is 50 acres.

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- Use of pretreatment measures to minimize basin clogging is recommended. These could include upstream vegetative controls to minimize soil erosion, a pre-settling basin to allow removal of floatables, settleable solids, and oil and grease, or water quality inlets on upstream storm drain lines. A sediment forebay or riprap apron should be provided to dissipate velocity from inflow and spread the flow over the floor of the basin.
- The minimum storage volume should be equivalent to 0.5 inches of runoff from the impervious portions of the tributary drainage area.
- The minimum basin depth should be 3 feet. The maximum basin depth will be a function of the volume requirements and site conditions, and should not exceed 12 feet.
- The maximum ponding time (or dewatering time) is 72 hours.
- The basin side slopes should not be steeper than 3:1 to prevent erosion.
- The basin bottom should be graded as flat as possible.
- The basin bottom and side slopes should be lined with a healthy stand of vegetation, or with a 6- to 12-inch layer of filter material or geotextile fabric.
- The basin should be provided with a bypass system or overflow device to allow for the passage of extreme storms. Overflows must be conveyed to a safe, non-erosive outlet.
- A vegetated buffer strip with a minimum width of 25 feet should be provided between the edge of the basin floor and the nearest adjacent lot.
- The potential for adverse impacts on local shallow ground waters should be considered in the siting and design process.

1502.4 Maintenance

Sediment and other material must be removed routinely to preserve the design storage volume and infiltration rate. Fine sediments left on the basin bottom reduce infiltration capacity and limit the basin effectiveness. Proper design and maintenance of the forebay can minimize the maintenance requirements for the rest of the basin. The performance of the infiltration basin should be checked after every major storm in the first few months after construction. In particular, the drain time should be monitored to assure that the design infiltration rate is being achieved. Thereafter, the basin should be inspected annually and cleared

of debris, litter and excess vegetation at least twice per year. Sediment accumulation may be an important maintenance concern in Las Vegas Valley. Sediment removal operations should utilize light equipment to avoid unduly compacting the basin floor.

1503 INFILTRATION TRENCH

1503.1 Description of Facility

An infiltration trench is a shallow excavation (generally 2 to 10 feet in depth) which is backfilled with sand or graded aggregates. Storm water from impervious surfaces can be directed to these facilities for infiltration and limited detention. The surface of the trench can be covered with stone, gabions, sand, or grass with a surface inlet. An alternative design is to build a vault or tank without a bottom. Permeable soils are a prerequisite for this BMP. **Figure 1502** shows a schematic drawing of an infiltration trench.

1503.2 Water Quality Benefits

The infiltration trench provides adequate control for soluble and small particulate pollutants generated from small watersheds. It should not be used to trap large-sized sediments, as these will lead to premature clogging of the facility. The infiltration trench is particularly adaptable to retrofit projects for small tributary watersheds. It is easily integrated into the un-utilized portions of commercial and industrial sites. This is one of the few BMPs to provide pollutant removal on small sites.

Pollutant removal occurs through exfiltration of captured runoff into the soil layer. Removal mechanisms include sorption, precipitation, trapping, straining, and bacterial degradation or transformation. If trenches are sized to capture only low flows and initial first flush runoff volumes (the normal design condition), typical removal efficiencies can be expected in the following range.

<u>Pollutant</u>	<u>Range of Long-Term Removal Efficiency</u>
Sediment	75 - 90%
Total Phosphorus	50 - 70%
Total Nitrogen	45 - 60%
Trace Metals	75 - 90%
BOD	70 - 80%
Bacteria	75 - 90%

1503.3 Design Criteria

- The maximum tributary watershed area should be 10 acres.
- Infiltration trenches should not be located in areas receiving high sediment loads; on fill sites; within 100 feet of water supply wells; or under buildings or pavement. They should be a minimum of 20 feet downslope and 100 feet upslope from building foundations.
- The trench depth is generally between 2 and 10 feet. The bottom should be level. The normal configuration is with a long, narrow excavation. The water table should be at least 2 feet below the bottom of the trench.
- The volume should be based on accepting 0.5 inches of runoff from the tributary impervious areas. Void spaces are assumed to be in the range of 30 to 40 percent.
- Backfill material may be 1/2- to 3-inch aggregate. The trench may be backfilled to within 3 inches of the ground surface.
- A minimum 20-ft wide vegetated buffer strip should be provided to assist in removal of floatables, settleable solids, and oil and grease.
- A positive overflow pipe or bypass conveyance system should be provided for large storm events.
- An observation well should be located in the center of the facility, constructed of 4- to 6-inch PVC.
- The trench bottom and walls should be lined with a permeable geotextile filter fabric with a minimum 12-inch overlap. Filter fabric may also be installed one foot below the ground surface to trap large sediment and debris in the event the overlying cover material is removed.
- Typical trench width is 18 to 36 inches.
- The maximum infiltration or dewatering time is 72 hours.
- A minimum infiltration rate of 0.3 inches per hour should be obtainable to be effective. Use a safety factor of 2.0 when sizing the trench volume and dewatering time.
- The in-trench overflow drain should be formed of perforated or slotted pipe. Large pipes can be used to add to the storage in the trench. Typical perforations are 3/8-inch diameter holes with not less than 30

perforations per square foot of pipe. The pipe drain should be located a minimum of 2 feet above the trench bottom.

- For Median Strip Design: Sheet flow is accepted from both sides of the infiltration trench, and is filtered through a 20-ft wide vegetated buffer strip graded at a slope of 5 percent. An overflow pipe is required to pass excess flows.
- For Parking Lot Perimeter Design: Sheet flow is accepted from the lower end of the parking lot. Slotted curb spacers are used as a level spreader at the edge of the parking lot to evenly distribute flows to the 20-ft wide vegetated buffer strip.
- For Swale Design: The swale collection system longitudinal slope should not exceed 5 percent. The trench should be located in the invert of the swale. Check dams may be required across the swale to increase the retention volume and prevent "short-circuiting" of the infiltration trench. See the section on "Vegetated Swales" for more information.

1503.4 Maintenance

Maintenance requirements for infiltration trenches are not great, consisting primarily of annual surface and water level inspections, buffer strip maintenance, and periodic surface sediment and debris removal. However, their small size and inconspicuous design can tend to leave them forgotten. Course sediment must be kept out of the trench to prevent premature clogging. If clogging does occur, a substantial portion of the backfill aggregate may have to be removed and replaced.

1504 POROUS PAVEMENT

1504.1 Description of Facility

Porous pavement is constructed of a special asphaltic or concrete paving material which allows storm water to infiltrate at a relatively high rate. Infiltrated water is stored below the pavement surface in a high-void aggregate base (stone reservoir) similar to an infiltration trench. This practice provides for storm water retention and increases infiltration into the ground. **Figure 1503** shows a typical porous pavement installation.

1504.2 Water Quality Benefits

Porous pavement generally provides significant reduction only in dissolved constituents, with a lesser reduction in fine particulate pollutants. Porous pavement is primarily designed to remove pollutants deposited on the pavement surface from the atmosphere; these pollutants are normally either very fine

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grained or soluble. The long-term removal efficiencies, based on limited field monitoring, is summarized below.

<u>Pollutant</u>	<u>Range of Long-Term Removal Efficiency</u>
Sediment	80 - 95%
Total Phosphorus	65%
Total Nitrogen	80 - 85%
COD	80 - 85%
Zinc	90 - 99%
Lead	90 - 98%

Porous pavement is useful as a substitute for conventional asphalt in parking areas and low traffic volume roads. Additional benefits include skid resistance, enhanced visibility, increased safety, and reduction of drainage system costs (e.g., related to curb and gutter). It is a reasonable cost-effective BMP where offsite runoff is not great, slopes are flat, soils are permeable, and depth to bedrock or the water table is relatively great.

1504.3 Design Criteria

- The soil subgrade should have adequate load-carrying capacity when wet, be well drained, and have high permeability.
- Maximum pavement slope is 5 percent; effectiveness is maximized when the slope is as flat as possible.
- A minimum clearance of 4 feet between the bottom of the underlying stone reservoir and bedrock or the water table is required.
- Porous pavement should be located no closer than 100 feet upslope from a building foundation, no closer than 10 feet downslope from a building foundation, and no closer than 100 feet from a drinking water well.
- Use is restricted to small drainage areas, with a maximum tributary area of 10 acres.
- The minimum storage residence time in the stone reservoir should be 12 hours; the maximum dewatering time should be 72 hours.
- Asphalt pavement thickness is determined by conventional soil strength/bearing and traffic load capacity design criteria. A minimum pavement thickness from the top of pavement to soil subgrade will generally be 9 inches. Construction requires an open graded type

aggregate in contrast to dense graded aggregate which is capable of close packing. A typical section consists of the following layers:

1. Porous asphalt course 2-4 inches thick
 2. Filter aggregate course
 3. Stone reservoir course with 0.5- to 3.0-inch diameter stone
 4. Filter fabric (geotextile)
- If concrete paving is used, then the following materials may be used: open graded mix, gap graded mix, draincrete, popcorn mix, or porous concrete. Use a low water-cement ratio of 0.20 to 0.40, and develop a pore space of at least 15 percent. Guarantee zero slump. Pavement can be placed directly on the subgrade, and can be expected to have permeability values of 2-3 gallons per minute.
 - Subsoils should have a minimum infiltration rate of 0.5 inches per hour. A safety factor of 2.0 should be applied to the actual infiltration rate for facility sizing.
 - The storage capacity should be based on retention of the first 0.5 inches of runoff from the impervious surfaces in the drainage area.
 - A system is required to remove excess storage volume. This may consist of a french drain, sand drain, two-layer system, or pipe drain.
 - An observation well should be installed consisting of a well-anchored, vertically perforated PVC pipe located at the downslope end of the pavement.
 - If the facility accepts flows from offsite areas, pretreatment may be required in the form of sand filters, vegetated buffer strips, water quality inlets, or other methods of separating oil, grit, and sediments.

1504.4 Maintenance

Porous pavement surfaces should be swept at least 4 times per year followed by jet hosing to prevent excess buildup of surface sediments and debris. If the pavement becomes clogged it is difficult and costly to rehabilitate. Applications should avoid areas where wind erosion supplies large amounts of dust and sediment. Because wind-borne particulates are found in significant quantities in the Las Vegas Valley environment, porous permanent installations should be in protected areas to the extent possible. Pavement should be inspected annually, checking for potholes, cracking, or surface ponding which might indicate clogging.

1505 FIRST FLUSH DIVERSION SYSTEM

1505.1 Description of Facility

First flush diversion systems are designed to divert the more polluted first flush of storm water and non-storm water flows from their normal conveyance paths and hold them for later water quality treatment. The diverted first flush and low flows are not discharged to surface water, but are stored until they are gradually removed by infiltration, evaporation, or some other form of treatment or removal. **Figure 1504** shows a typical first flush diverter installed in a storm drain line.

1505.2 Water Quality Benefits

First flush diversion is one of the most effective ways of enhancing storm water quality. Potentially polluted waters are separated from the cleaner flows, and thus whatever treatment or management systems are employed can deal with a smaller volume of water. Diversion systems can readily be installed in existing storm drain lines, as long as locations for off-line storage and treatment can be identified. First flush diversion systems are appropriate "pretreatment facilities" for other BMPs such as infiltration basins, infiltration trenches, and detention basins.

1505.3 Design Criteria

- The hydraulic capacity of the diversion structure should be set such that it does not represent a bottleneck to the storm drain system.
- The diversion line (i.e., first flush and low flows diverted out of the main storm drain line) should be designed to convey the runoff from 0.5 inches of rain over the tributary area.
- The overflow baffle should be designed to pass the full storm drain design flow in case the diversion line is plugged or the treatment facility is full and backflowing to the diversion structure.
- The diversion structure should be provided with a manhole access for cleaning and inspection.

1505.4 Maintenance

First flush diversion structures should be cleaned at least twice per year. The facilities should be inspected after large storms and after all significant "first flush storms" occurring after an extended dry period.

1506 DRY EXTENDED DETENTION POND

1506.1 Description of Facility

A dry extended detention pond is similar to a standard dry detention pond (i.e., a detention pond without a permanent pool of water), but the outlet control structure is modified to extend the detention time for low flows. This extended detention time leads to higher pollutant removal rates than in standard detention basins. Typical outlet control structures can be modified through use of devices which reduce outflow rates at low pond stages, but which preserve high outflow rates at high stages. Extended dry detention ponds are not recommended for small areas (less than 20 acres); other infiltration-based BMPs should be used for these smaller applications. **Figure 1505** shows a typical dry extended detention pond.

1506.2 Water Quality Benefits

Dry extended detention ponds remove pollutants through the settling process. Sediments and the pollutants adhered to them, such as trace metals, are the constituents most effectively controlled by dry detention basins. If the storm water is detained for 24 hours or more, as much as 90 percent of particulate pollutant removal is possible. The majority of pollutant removal occurs within the first 6 hours of detention. Extended detention is extremely cost effective where a basin is required for flood control, and seldom costs more than 10 percent more than costs reported for conventional dry ponds.

The degree of pollutant removal is dependent on whether a given pollutant is in particulate or soluble form. Unfortunately, some of the urban pollutants of greatest concern occur primarily in soluble forms (e.g., nitrate and orthophosphorus). Improved removal of soluble pollutants may be obtained by managing the shallow portion of the pond as a wetland to utilize natural biological removal processes. Long-term pollutant removal efficiencies for approximately 6 to 48 hours of detention time are estimated below.

<u>Pollutant</u>	<u>Range of Long-Term Removal Efficiency</u>
Sediment	60 - 90%
Total Phosphorus	15 - 50%
Total Nitrogen	25 - 40%
BOD/COD	25 - 50%
Trace Metals	30 - 90%
Hydrocarbons	50 - 70%

1506.3 Design Criteria

- The treatment volume should be equivalent to the runoff volume produced by a 2-year, 6-hour storm over the tributary area. Additional "active storage" volume may need to be provided to meet flood control objectives.
- A minimum detention time of 24 hours should be provided for the design storm. Additional time up to 40 hours will improve pollutant removal efficiency. Smaller events (e.g., 0.1 inch storms) should be detained a minimum of 6 hours.
- In general, pond depths should not exceed 6 feet, particularly in multiuse park or school sites.
- Aforebay should be provided at the pond inlet to capture incoming large sediment and debris.
- Common types of extended detention outlet control devices include: (1) internally controlled perforated pipe; (2) perforated riser; (3) inlet-controlled perforated pipe. All extended detention devices should be surrounded by a filter of gravel or coarse stone and filter fabric. The minimum perforation diameter should be 0.5 inches.
- Minimum setbacks should be 20 feet from any structure or property line; 100 feet from septic tanks or drainfields; and 50 feet from any steep slope. The 20-ft buffer setback should be landscaped using low-maintenance vegetation.
- Pond geometry should be selected to maximize mixing and detention time. This should include use of irregular shorelines; length-to-width ratios of no less than 3:1; and baffles or islands.
- Side slopes should be a minimum of 3:1 to provide bank stability, and a maximum of 20: 1.
- The pond overflow system should provide for the controlled release of the 100-year storm runoff. This can be accomplished using open end risers. In addition, an overflow spillway should be provided to pass the full 100-year peak discharge for in-line or in-channel basins.
- If soils at the site are highly permeable (e.g., SCS hydrologic soil groups A or B), then it may be necessary to line the pond bottom and sides with an impermeable geotextile or a 6-inch clay liner.

- Extended detention ponds should be designed in two levels. The upper level should be sized and graded (2 percent minimum slope) to be dry except during large, infrequent storm events. The lower level, near the riser or outlet works, should be designed to be inundated regularly. Ensure that no low points or sumps develop in the upper level that might fill with standing water. The volume of the lower level should be sized to store the runoff produced from the mean annual (2-year) storm.
- A lined low flow channel should be designed to drain the upper level to the lower level, and to drain the lower level to the outlet works.

1506.4 Maintenance

Dry extended detention ponds have moderate to high maintenance requirements. The primary maintenance problem in dry extended detention ponds results from the accumulation of sediment and debris, particularly near the riser or outlet works. Design of a proper forebay can minimize this problem. Nonetheless, routine removal of sediment, vegetation and other debris will be necessary. Facilities should be inspected annually and after each major storm to assure that the system is operating as designed. Inspections should check to assure that: (1) the pond is draining properly; (2) subsidence or erosion of the pond bottom have not occurred; (3) nuisance conditions associated with litter, weeds or odor have not developed. The landscaped buffer strip will require routine maintenance, depending on the landscaping material selected.

1507 VEGETATED SWALE

1507.1 Description of Facility

This BMP involves using vegetated (normally grass) channel surfaces for runoff conveyance to reduce flow velocities, enhance filtration, and remove runoff contaminants. Grassed swales consist of a mildly sloping cross section with check dams to increase infiltration and flow attenuation. Typical applications are along roadways in place of curb and gutter, and adjacent to large parking areas. A sketch of a typical vegetated swale is shown in **Figure 1506**. In the arid Las Vegas Valley climate, vegetated swales will only be practical where they can be easily incorporated into irrigated landscaped areas. This will likely limit their application in Las Vegas Valley.

1507.2 Water Quality Benefits

Vegetated swales generally provide reductions in sediment load and the constituents which typically adhere to sediments (e.g., heavy metals). Pollutants are removed by the filtering action of the grass, deposition in low velocity areas, and infiltration into the subsoil. Biofiltering action can reduce loads of soluble constituents if the height of the vegetation is sufficient as compared to the

design flow depth and contact times are long. Performance of swales for pollutant removal varies widely, with generally low to moderate removal efficiencies reported. If used, every effort should be made to maximize swale effectiveness through proper siting and design.

1507.3 Design Criteria

- The design flow should be limited to 5-10 cfs. The velocity should be limited to 2 ft/sec. The flow depth should be limited to 12 inches.
- Side slopes should not be steeper than 3:1. Longitudinal slopes should not exceed 4 percent. For slopes less than 2 percent, underdrains may be required.
- The minimum swale length for desirable water quality benefit is 100 feet.
- Below the design water depth, an erosion control blanket should be installed along with at least 4 inches of topsoil and the selected biofiltration mix. Above the design water depth, an erosion control seed mix with mulch or sod should be used. The topwidth-to-depth ratio should generally be 6:1 or greater.
- Check dams may be constructed of a variety of materials, varying from earthen berms to concrete. Check dam spacing should be selected to keep the longitudinal slope below 4 percent. Upstream ponding volume at the check dams should be limited to drain within 24 hours. Check dam height should not exceed 18 inches. It should be recognized that use of hard check dams in swales along roadways may represent a safety hazard to vehicles; in these applications dam heights should be minimized and below-surface grade control measures should be considered.
- Alkaline soils and subsoils promote metals removal. Metal removal efficiency can also be enhanced by spreading a layer of organic material on the natural soil. Soil infiltration rates exceeding 0.3 inches per hour are preferred.
- In Las Vegas Valley, selection of vegetation should be made on the basis of what will survive best in the local conditions. Fine, close-growing, water resistant grasses are preferred. Local entities have developed lists of recommended grasses and vegetation for landscaping with water conservation in mind. Prevent bare areas by avoiding gravel, rocks, and hardpan near the surface. Irrigation and fertilization will be required to maintain healthy vegetation on a year-round basis. Subdrains may be required to prevent excess irrigation runoff.

1507.4 Maintenance

Primary maintenance activities involve removal of accumulated sediment and debris, and care of the vegetation. In Las Vegas Valley the second factor will probably be most important. Irrigation, fertilization, and mowing will be required to develop the healthy vegetation necessary to develop an effective biofilter. It is noted that over irrigation and over fertilization can be detrimental to downstream water quality.

1508 WATER QUALITY INLET

1508.1 Description of Facility

The water quality inlet (also known as an oil-grit or oil-water separator) is designed to remove sediment and hydrocarbon loadings from parking lot runoff or areas contributing potential oil or grease. The structures generally consist of multi-chambered underground vaults (usually three chambers) which can be installed in place of conventional catch basins or inlets. The first chamber acts as a sediment trap, the second chamber collects oil and grease floating on the surface of the water, and the third chamber directs flow to a storm drain outlet. Water quality inlets generally serve areas less than one acre in size. **Figure 1507** shows a schematic diagram of a typical water quality inlet.

1508.2 Water Quality Benefits

Water quality inlets are designed to separate relatively heavy sediments and floating hydrocarbons from the runoff stream. Typical application areas include industrial machinery yards, vehicle storage yards, petroleum bulkstorage areas, gas stations, retail merchandise stores, and fast food stores. They have no significant storage volume and operate on an essentially flow-through basis. As a result, they are not effective in controlling dissolved constituents or those not attached to the sediment particles. In addition, they are effective only for small drainage areas. Water quality inlets are useful in retrofitting existing industrial areas by replacing conventional inlets. They are also useful as "pretreatment" facilities for infiltration basins or trenches.

Pollutant removal capability of water quality inlets has not been extensively tested in the field, so numerical efficiency estimates are largely a matter of speculation. Factors working against performance include the small storage volume, low detention time, and resuspension of pollutants for multiple storms occurring between clean-out operations.

1508.3 Design Criteria

- Use for impervious areas of less than one acre. Any rooftop drainage is not likely to be significantly contaminated, and can be discharged downstream of the water quality inlet.
- A temporary pool 3 to 4 feet deep should be created in the first chamber for gravity settling and capture of floatables.
- The second chamber also has a temporary pool, and is connected to the first chamber by a pair of screened 6-inch holes.
- The third chamber is connected to the second by an inverted pipe to prevent transfer of floating hydrocarbons to the third chamber.
- Combined wet storage volume in the temporary pools in the first and second chambers should be sized based on 400 cubic feet per tributary acre. The remaining dry storage area must pass the design storm.
- After the storm, the first two chambers are drained by 6-inch weep holes in the floor.
- Each chamber should be provided with removable covers or manhole access.
- The floor of each chamber should be sloped slightly away from the outlet to the next chamber to minimize resuspension of settled particles. Vertical baffles on the floor of the first and second chamber may also be effective in preventing resuspension.

There are several special adaptations of the standard water quality inlet design. These include:

- a. The American Petroleum Institute (API) Separator, consisting of a long vault with baffles to improve hydraulic conditions for treatment. It is designed to remove oil droplets 150 microns and larger in size.
- b. The Coalescing Plate Interceptor (CPI), which contains a bundle of closely spaced plates made of fiberglass or polypropylene. It can be designed to remove oil droplets 60-90 microns and larger in size.

More detailed design criteria can be obtained for these special oil-water separators.

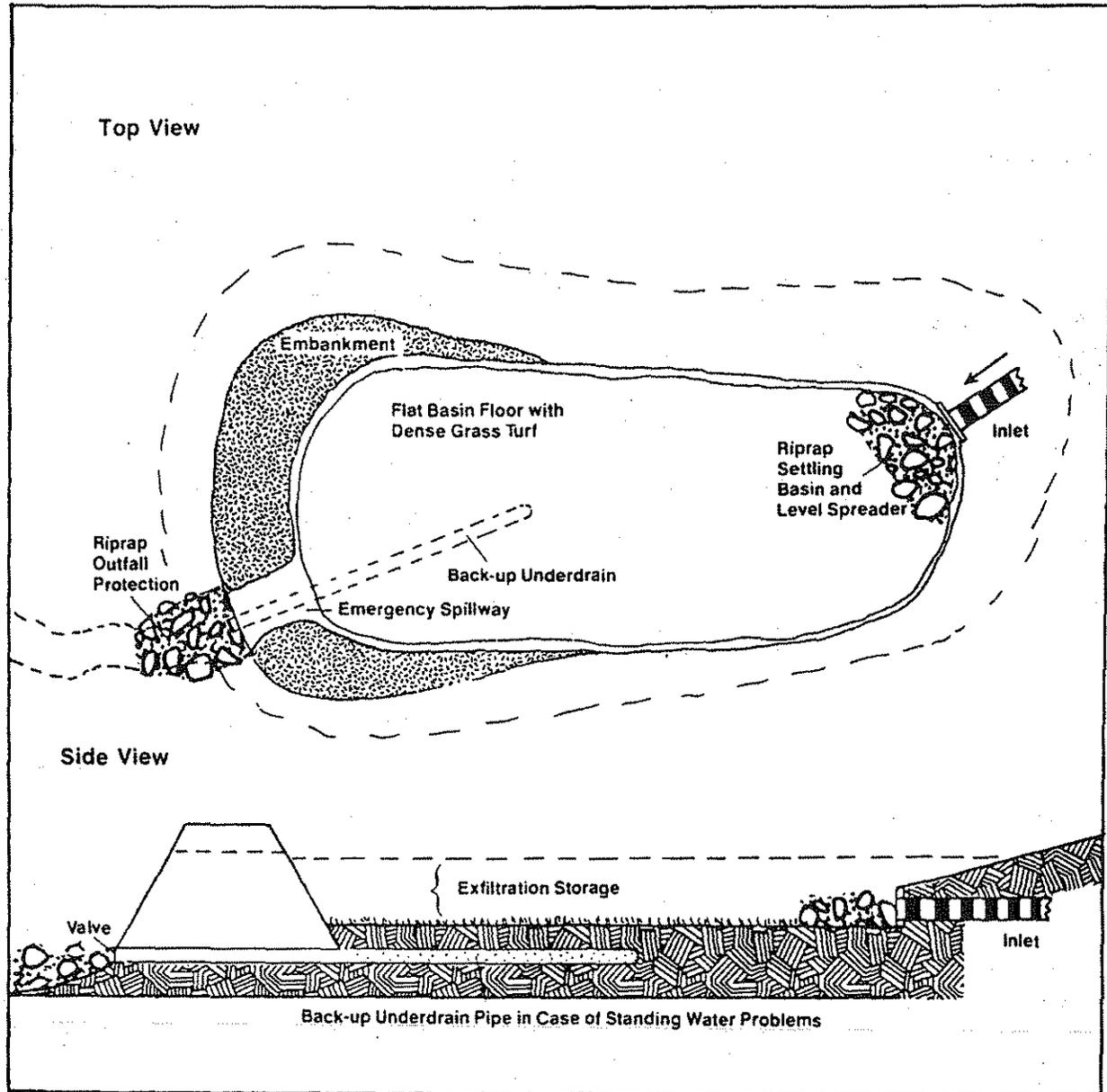
1508.4 Maintenance

Water quality inlets should be cleaned out a minimum of twice per year with a vacuum truck. Accumulations of sediments and hydrocarbons will reduce the effectiveness of the facility, through resuspension of material from previous storms and pass-through of material from new storms. In addition to normal twice-per-year cleanings, inlets should be cleaned after "first flush storms" occurring after extended dry periods when concentrations of oil/grease and heavy metals are expected to be highest. Due to the small storage volume involved, facility performance is very dependent on frequent and thorough cleaning operations.



HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SCHEMATIC DRAWING OF A TYPICAL INFILTRATION BASIN



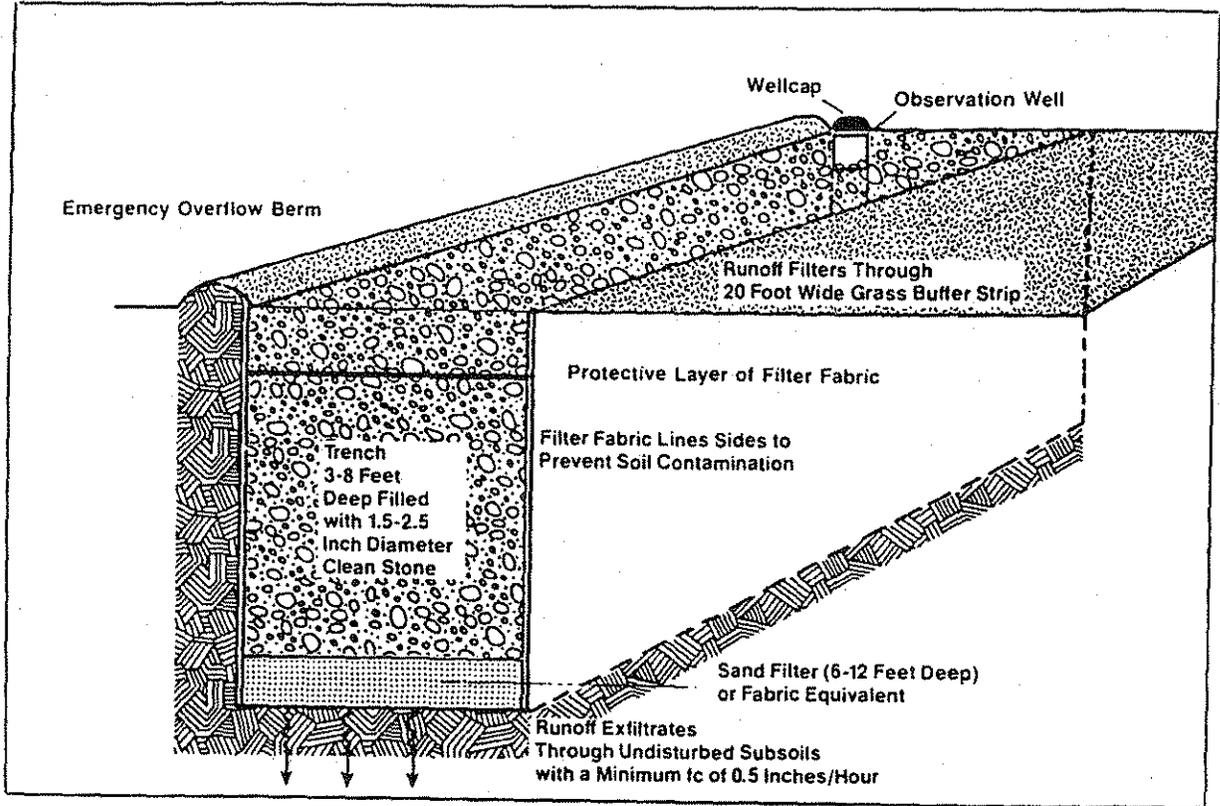
Revision	Date

REFERENCE: Controlling Urban Runoff:
A Practical Manual for Planning and Designing
Urban BMPs, July 1987

FIGURE 1501



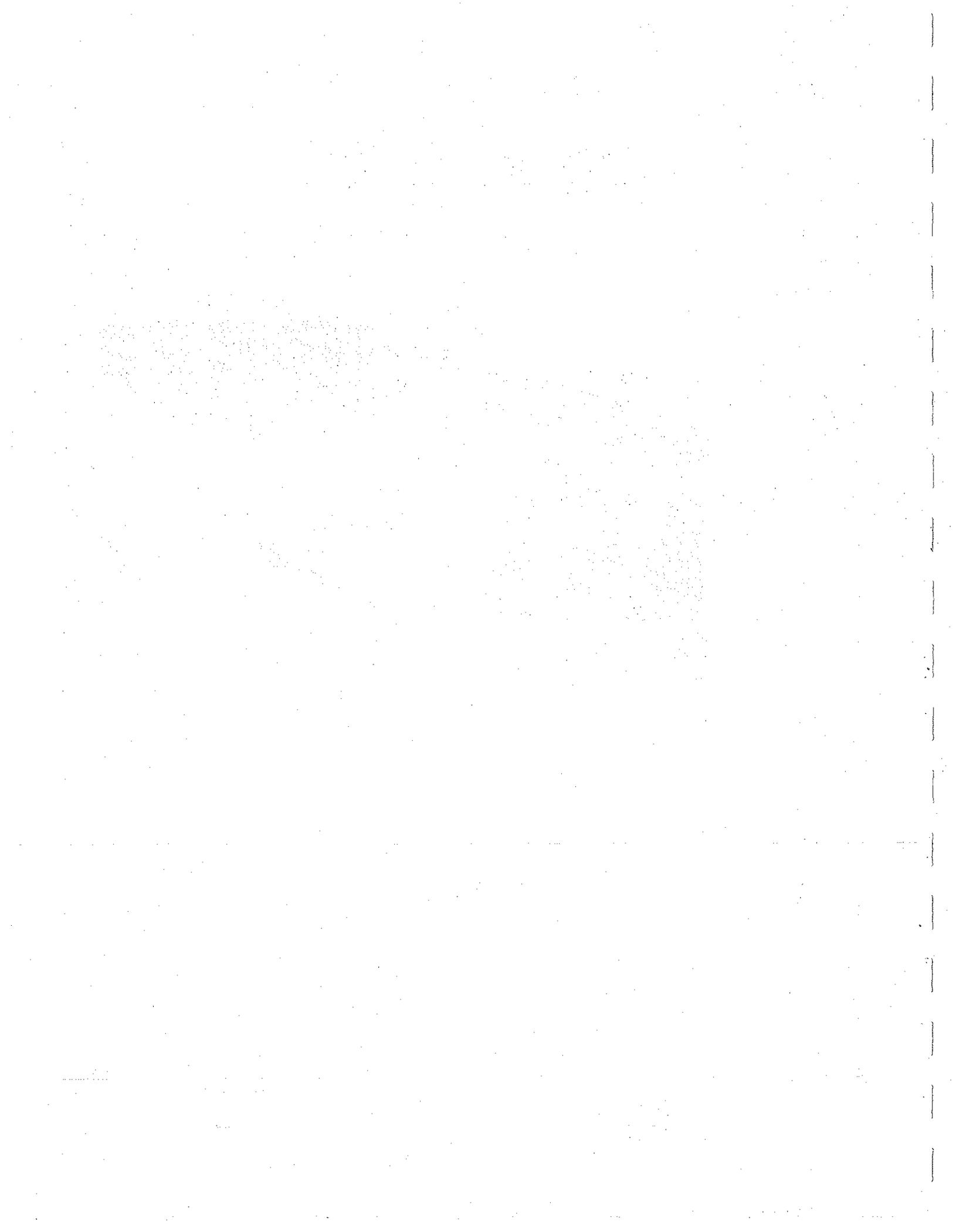
**SCHEMATIC DRAWING OF A
TYPICAL INFILTRATION TRENCH**



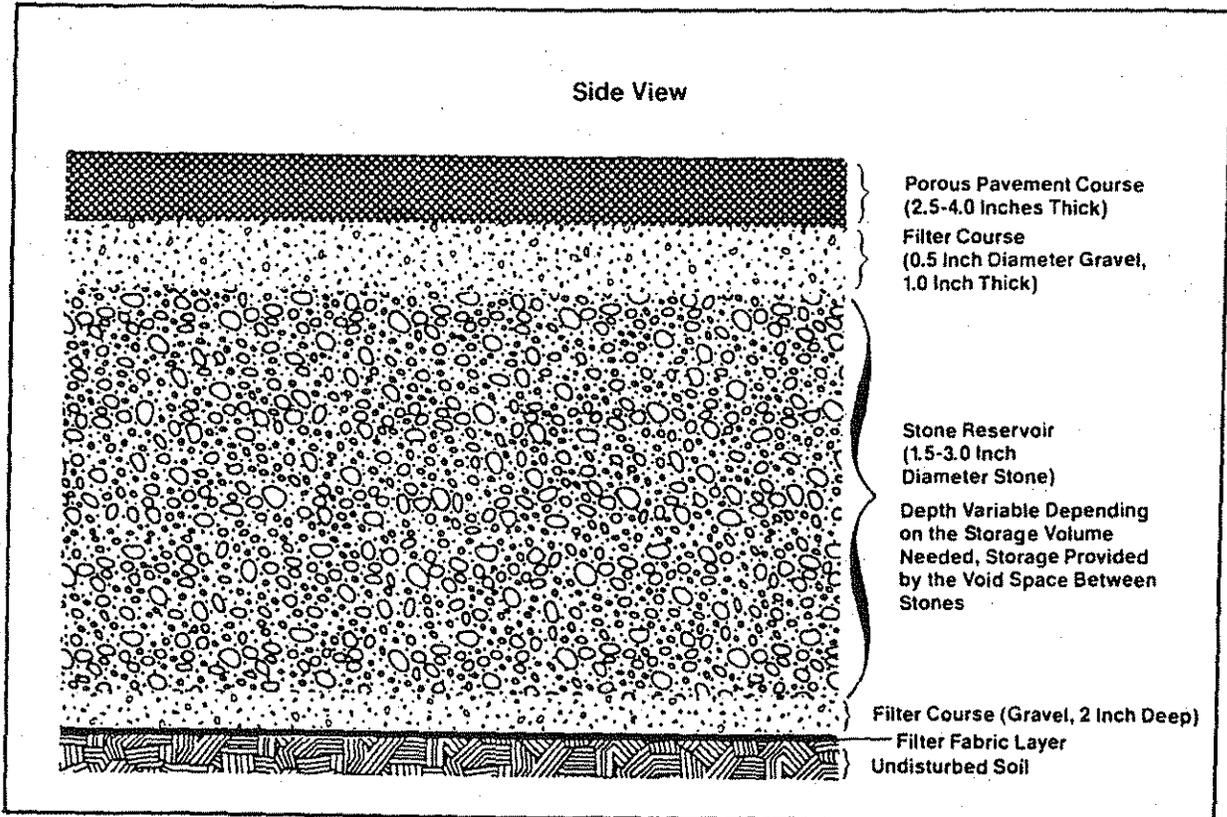
Revision	Date

REFERENCE: Controlling Urban Runoff:
A Practical Manual for Planning and Designing
Urban BMPs, July 1987

FIGURE 1502



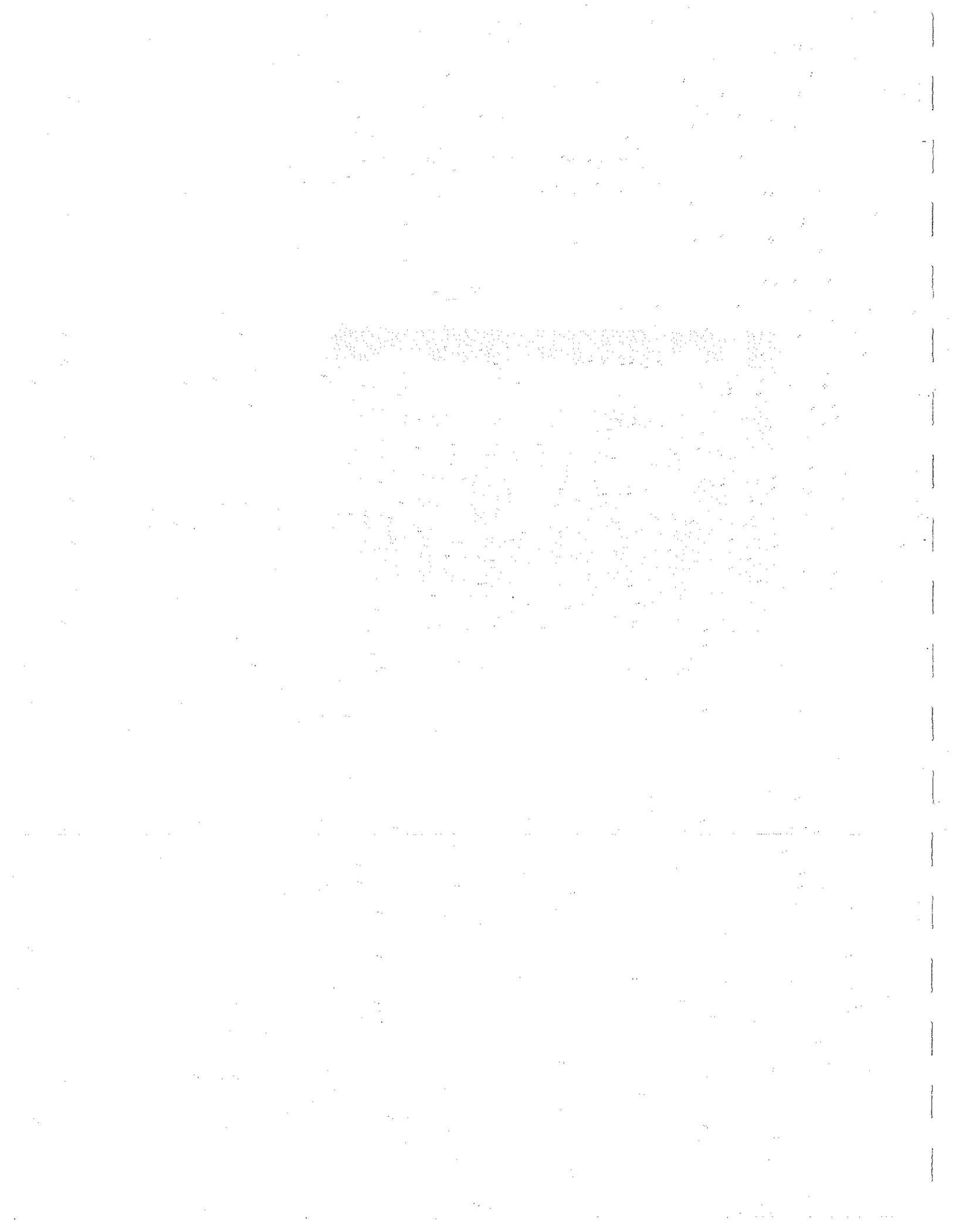
**SCHEMATIC DRAWING OF A
TYPICAL POROUS PAVEMENT SECTION**



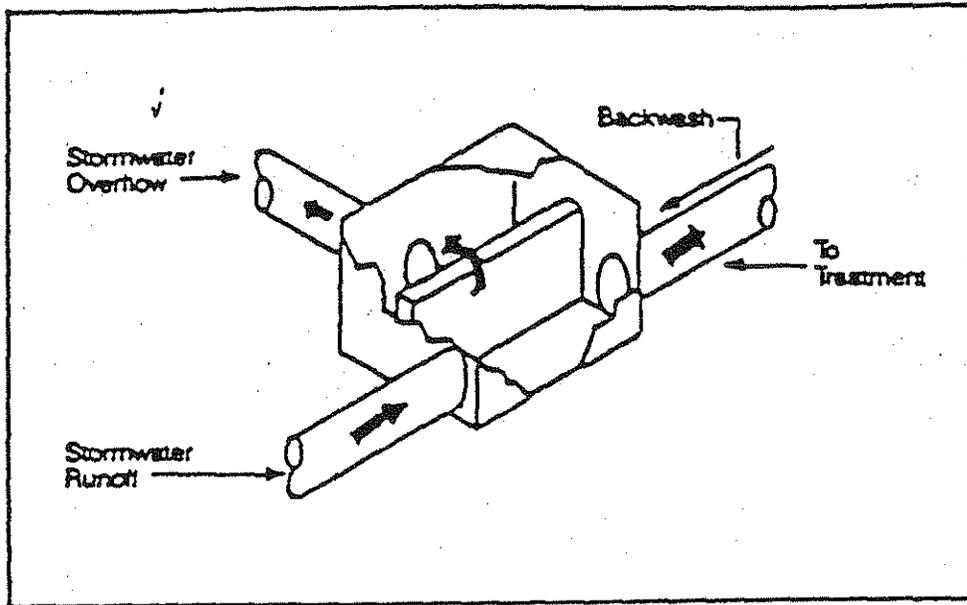
Revision	Date

REFERENCE: Controlling Urban Runoff:
A Practical Manual for Planning and Designing
Urban BMPs, July 1987

FIGURE 1503



**SCHEMATIC DRAWING OF A
TYPICAL FIRST FLUSH DIVERSION BOX**



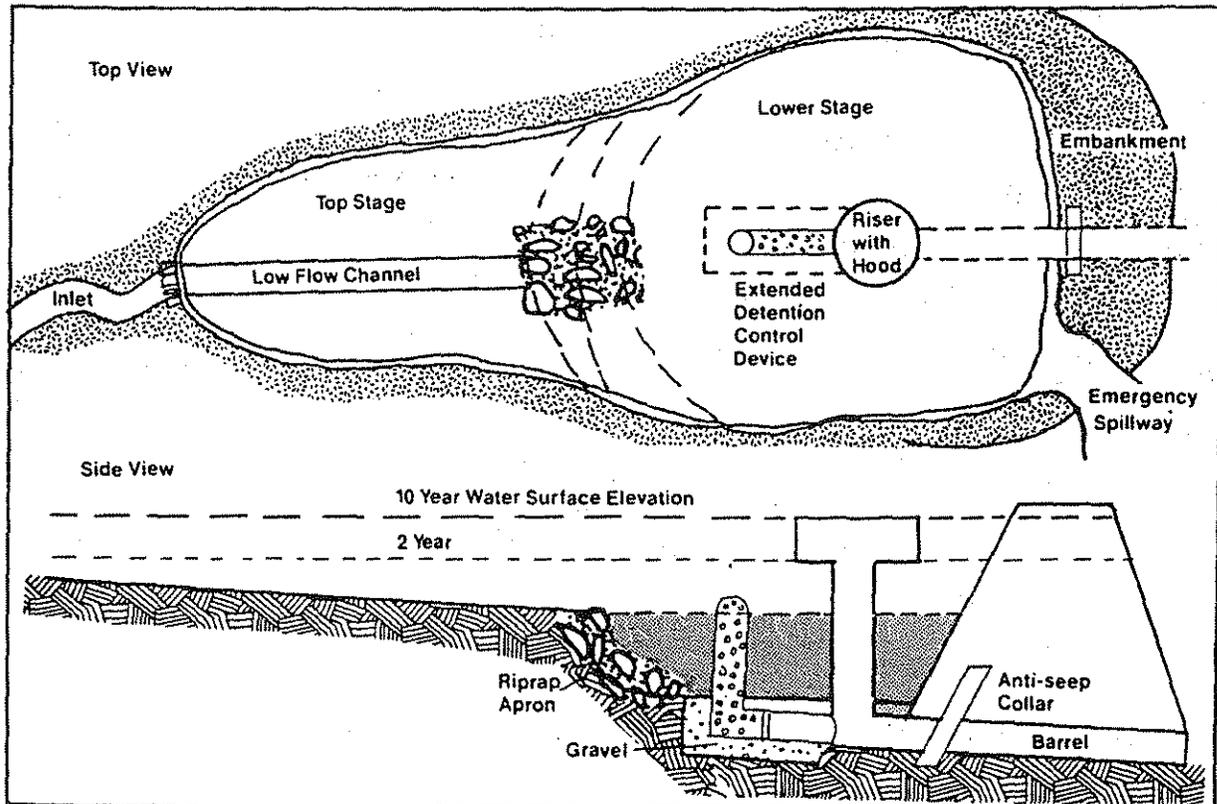
Revision	Date

REFERENCE: Controlling Urban Runoff:
A Practical Manual for Planning and Designing
Urban BMPs, July 1987

FIGURE 1504



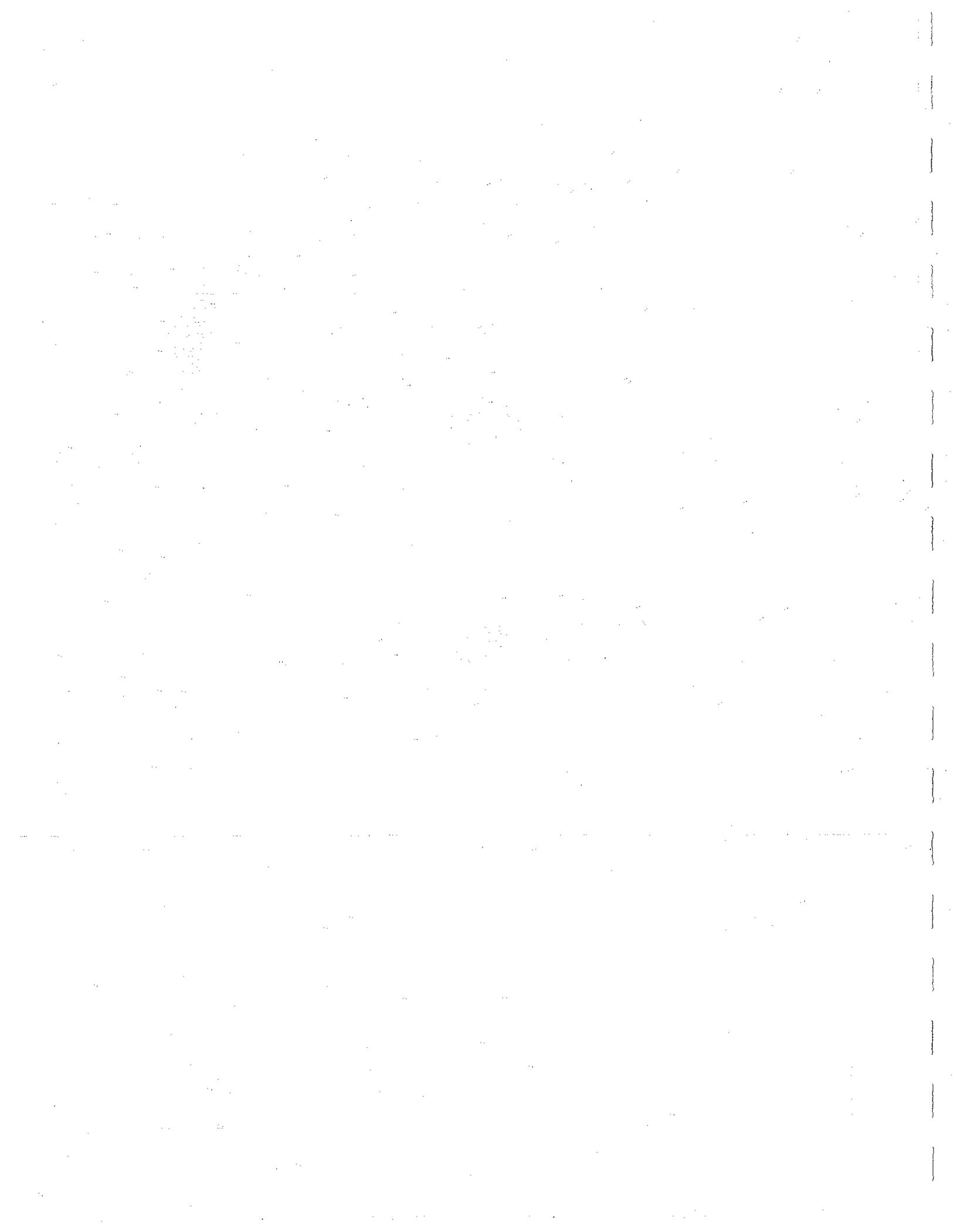
**SCHEMATIC DRAWING OF A
TYPICAL DRY EXTENDED DETENTION POND**



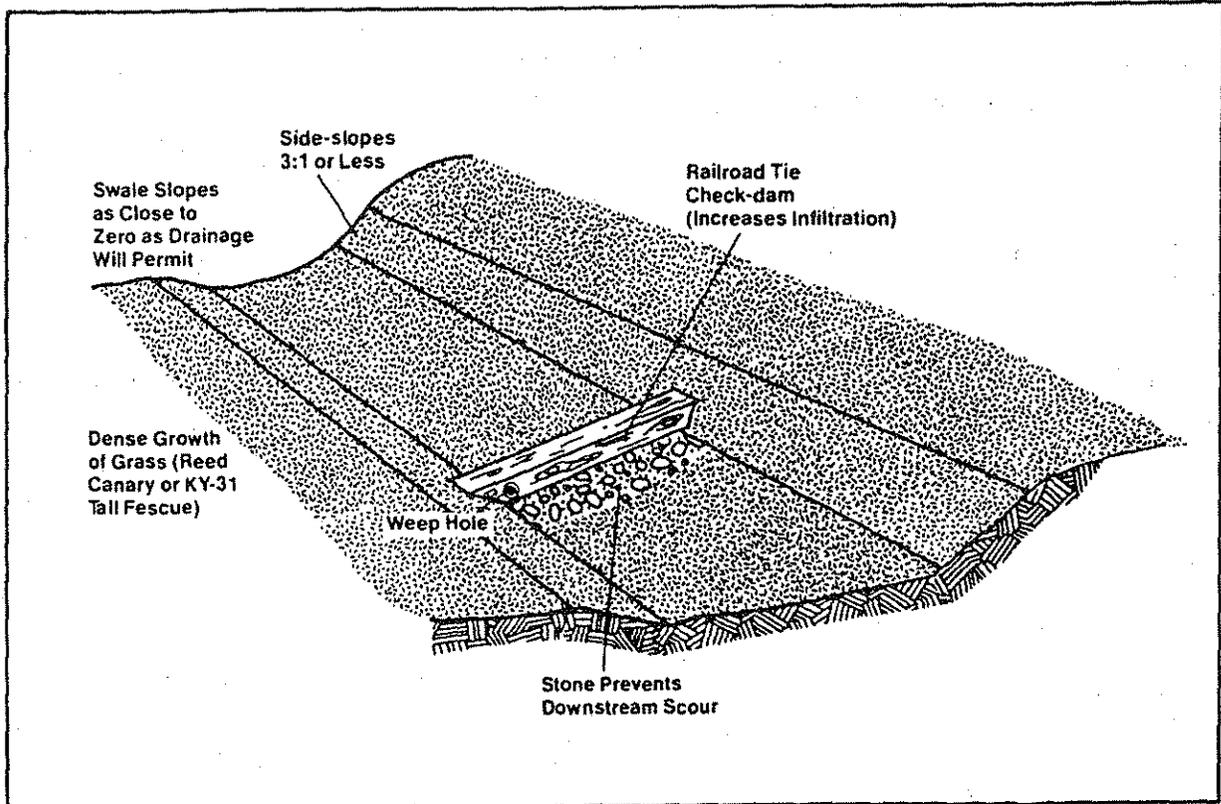
Revision	Date

REFERENCE: Controlling Urban Runoff:
A Practical Manual for Planning and Designing
Urban BMPs, July 1987

FIGURE 1505



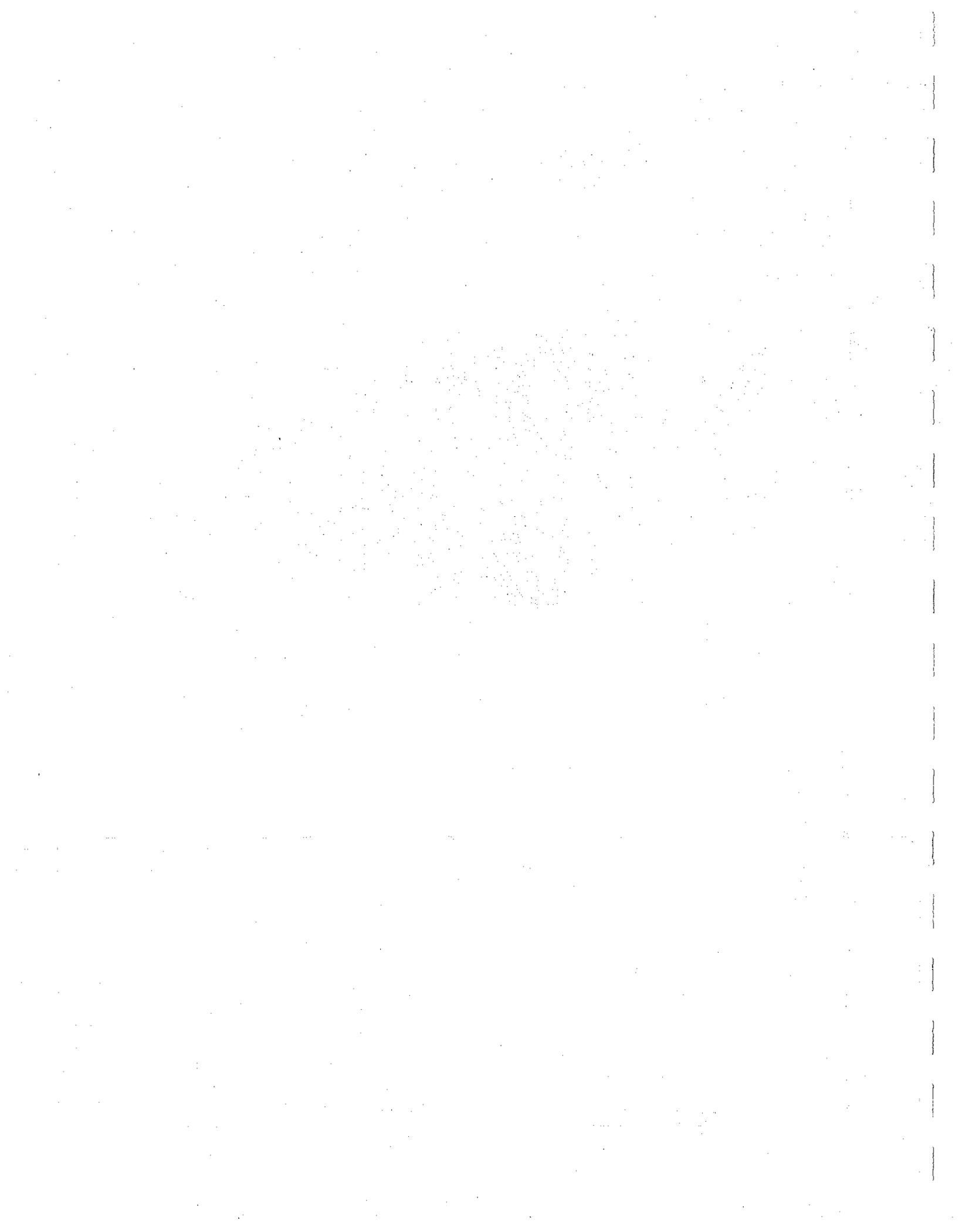
**SCHEMATIC DRAWING OF A
TYPICAL GRASSED SWALE**



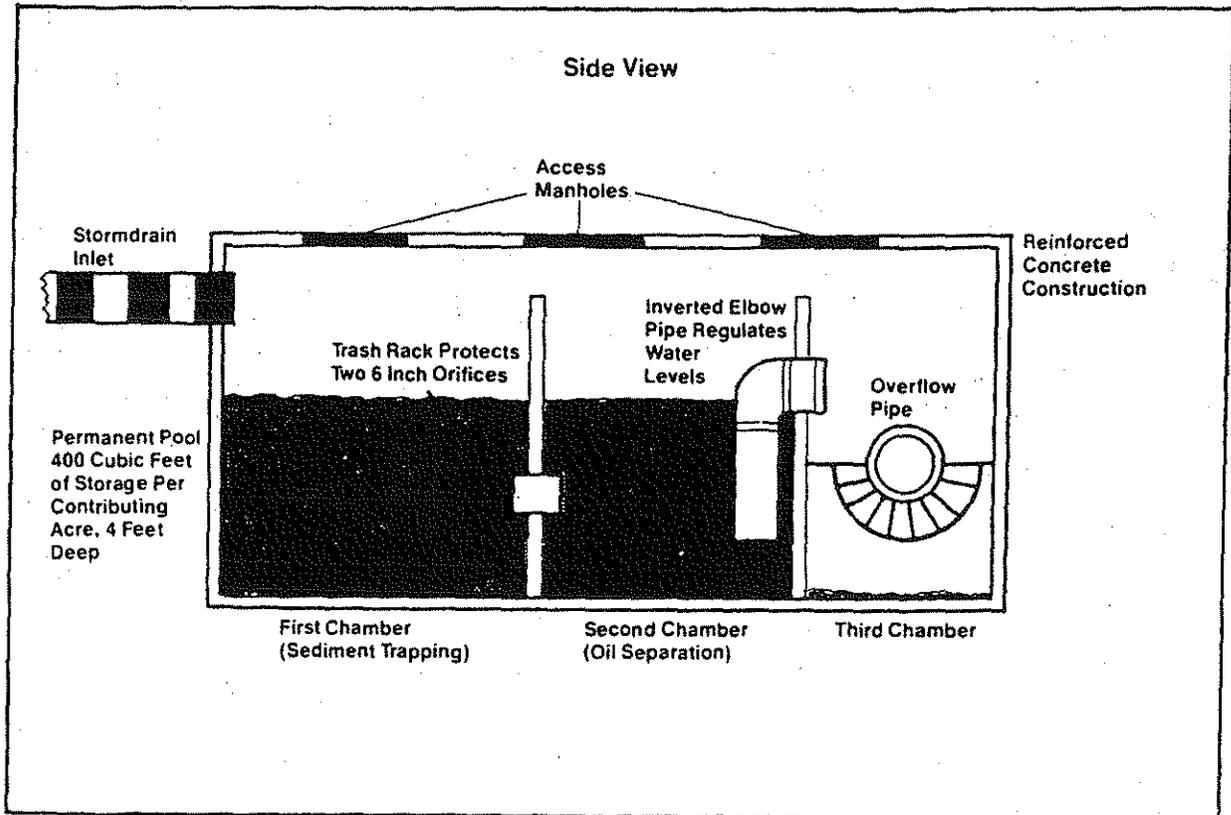
Revision	Date

REFERENCE: Controlling Urban Runoff:
A Practical Manual for Planning and Designing
Urban BMPs, July 1987

FIGURE 1506



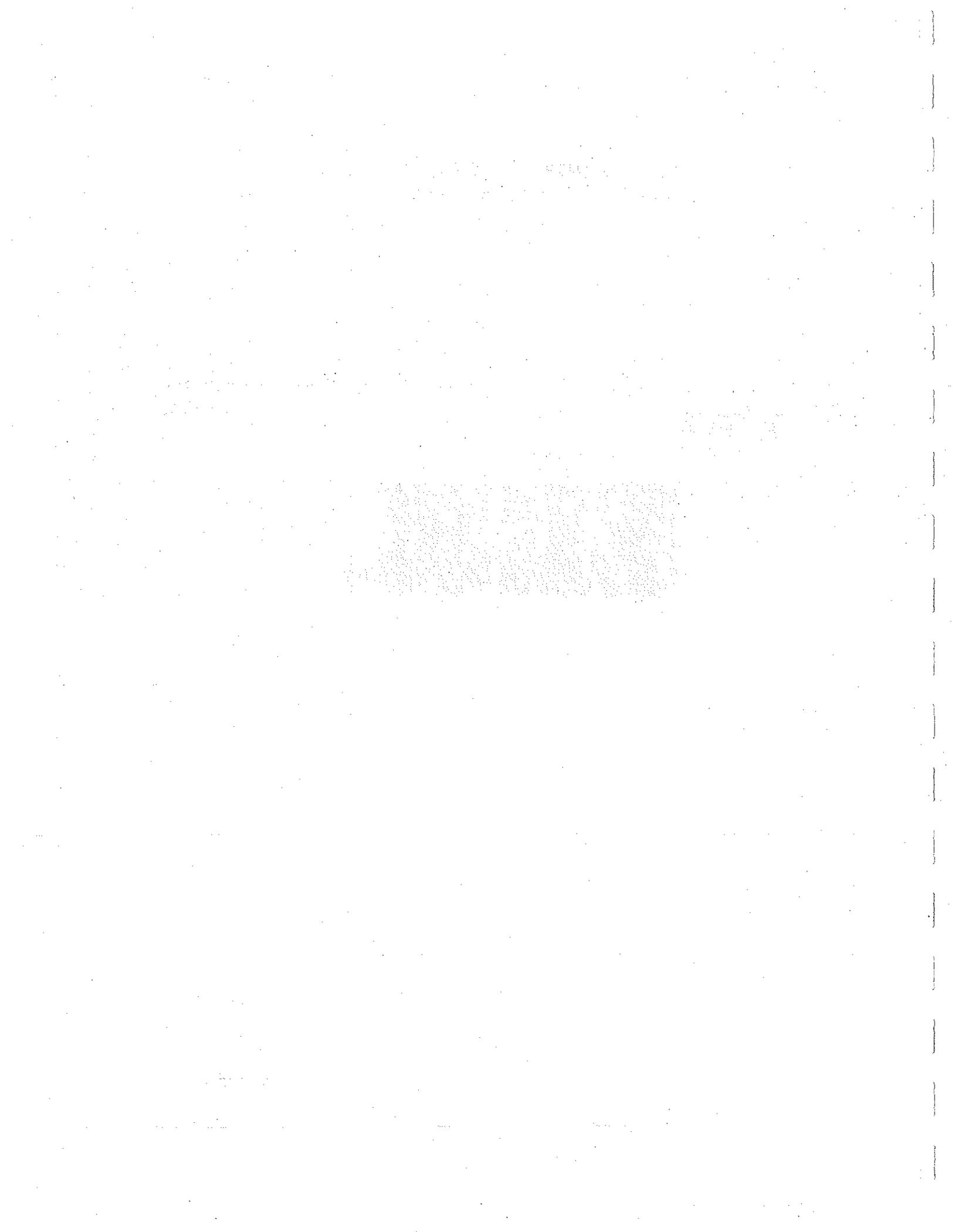
**SCHEMATIC DRAWING OF A
TYPICAL THREE-CHAMBER WATER QUALITY INLET**



Revision	Date

REFERENCE: Controlling Urban Runoff:
A Practical Manual for Planning and Designing
Urban BMPs, July 1987

FIGURE 1507



Section 1600

Local Entity Criteria

1601 CITY OF HENDERSON

Section 201

The City of Henderson shall require **Standard Form 1** be included with every submittal to the City.

The City of Henderson shall require the latest copy of all grading plans and any necessary improvement drawings to evaluate the control of drainage for the project are included with every submittal to the City.

The City of Henderson shall require an exhibit showing which lots are being protected by any proposed facilities. The City will not issue any building permits for any lots impacted by this exhibit prior to the associated facilities being completed.

Section 203.3

Parcel Map Drainage Study requirements:

- a) Parcel Maps dividing land into parcels greater than 2 acres shall complete a Conceptual Study for the purpose of defining off-site flow impacts and to determine if any drainage easements are required.
- b) Parcel Maps dividing any land into parcels less than or equal to 2 acres shall complete a Technical Drainage Study as defined in Section 204.

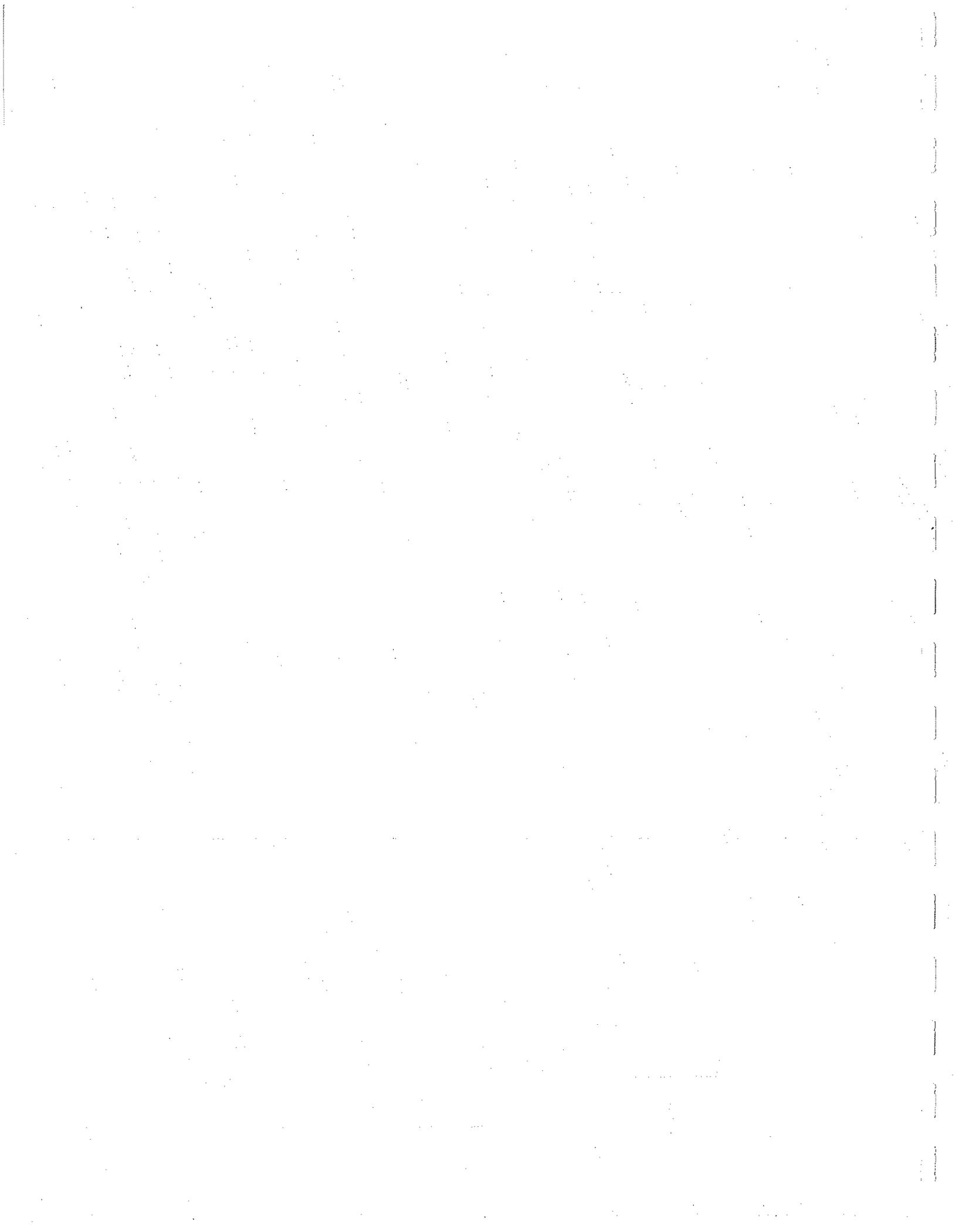
Section 303.1.3, Paragraph 1

The City of Henderson will allow nuisance water to travel a maximum length of 1,000 feet or across the front of 20 lots before it is required to be conveyed within a storm drainage system.

Section 303.10

The City of Henderson requires a minimum 20-foot wide easement for all publicly maintained facilities per the current City of Henderson Development Code.

The City of Henderson will require a surface overflow path with the capacity for the major storm in addition to any proposed underground facility. The overflow path will not be required to meet the same criteria as if it were the primary flow



Responses to Public Comments on Draft EIS and Draft HCP

Response to Public Comments on Draft EIS for the SLCHCP Project

Agency	EIS Comment #	Section	Subsection	Page	Paragraph, Sentence	Comment	Response
SNWA	1 (K. Albright 2/18/09)	4	Table 4-2	4-15		Table 4-2 describes perennial yield and water rights for Delamar and Dry Lake Valleys, which should be updated to reflect the July 2008 Nevada State Engineer rulings on those valleys (Ruling 5875).	Text has been revised in Table 4-2 in Section 4.2.5.1 of the EIS to reflect the current permitted water rights for Dry Lake Valley of 11,584 afy and 2,493 afy for Delamar Valley pursuant to the State Engineer issued Ruling 5875 on July 9, 2008.
SNWA	2 (K. Albright 2/18/09)	4	4.2.5.1	4-16		Should be updated to reflect that the USGS Basin and Range Carbonate Aquifer System Study has been completed.	The sentence that reads "The "Basin and Range Carbonate Aquifer System Studies" (BARCASS) is mandated by the LCLA and is being carried out by the USGS, the Desert Research Institute, and the Utah State Engineers Office" has been deleted from the third paragraph in Section 4.2.5.1 of the EIS.
SNWA	3 (K. Albright 2/18/09)	5	5.23.1.9	5-55		Describes the Clark, Lincoln, and White Pine Counties Groundwater Development Project. This should be revised to reflect the current project description, which is provided in SNWA's December 2008 Conceptual Plan of Development (available on the SNWA website or can be provided upon request).	The text in Section 5.23.1.9 of the EIS which summarizes the Clark, Lincoln, and White Pine Counties Groundwater Development Project has been updated to reflect the current project description and recent rulings granted by the Nevada State Engineer.
SNWA	4 (K. Albright 2/18/09)	5	Table 5-2	5-65		Should be updated to reflect the July 2008 Nevada State Engineer rulings on water right applications in Delamar and Dry Lake Valleys (Ruling 5875).	Text has been revised in Table 5-2 in Section 5.23.5.5 of the EIS to reflect the current permitted water rights for Dry Lake Valley of 11,584 afy and 2,493 afy for Delamar Valley pursuant to the State Engineer issued Ruling 5875 on July 9, 2008..
SNWA	5 (K. Albright 2/18/09)	5	Table 5-3	5-65		Describes the Clark, Lincoln, and White Pine Counties Groundwater Development Project. This should be updated to reflect the current project quantity of approximately 170,000 afy and removal of Coyote Spring Valley from the project (see SNWA's December 2008 Conceptual Plan Development).	Text has been revised in Table 5-3 in Section 5.23.5.5 of the EIS to reflect the current project quantity of approximately 170,000 afy and the deletion of Coyote Spring Valley as one of the hydrographic basins associated with the project.
SNWA	6 (K. Albright 2/18/09)	5	5.23.2.5.1	5-67		Under groundwater, describes effects of climate change as lower infiltration and recharge of groundwater aquifers. This description should recognize that few studies have examined the sensitivity of groundwater systems to a changing climate. The U.S. Climate Change Science Program (<i>The Effects of Climate Change on Agriculture, Land Resources, Water Resources and Biodiversity in the United States: Synthesis and Assessment Product 4.3, 2008</i>) stated that the ability to predict the effects of climate and climate change on groundwater systems is nowhere near advanced as for surface water systems, and identified work that has shown both increases and decreases to recharge as a result of climate change. Thus, assuming that temperature, precipitation, and surface water changes would manifest into lower infiltration and recharge should be quantified as currently speculative.	The following sentences have been added to the last sentence under Section 5.23.2.5.1 of the EIS for further clarification. "However, few studies have examined the sensitivity of groundwater systems to a changing climate. The U.S. Climate Change Science Program (CCSP) stated that the ability to predict the effects of climate and climate change on groundwater systems is nowhere near advanced as for surface water systems, and the existing studies have shown both increases and decreases to recharge as a result of climate change (CCSP 2008)."
SNWA	7 (K. Albright 2/18/09)	5	5.23.2.5.1	5-67		Describes under Surface Water Hydrology that groundwater development projects have the potential to affect surface water flows on the Muddy and Virgin Rivers. While the Muddy River originates from spring flows in the Upper Moapa Valley, the Virgin River originates from headwaters in Utah. Therefore, the identified past, present and reasonably foreseeable future groundwater projects would not be anticipated to have measurable effects on Virgin River surface water flows.	Section 5.23.2.5.1 has been revised to include the recent findings from the potential effects to surface water flows of the Virgin River, Clover Creek, and Meadow Valley Wash from implementation of groundwater projects, such as the LCLA Groundwater Development Project.
SNWA	8 (K. Albright 2/18/09)	5	5.23.2.5.2	5-67		Under Groundwater for the Preferred Alternative, states that significant cumulative impacts would be unlikely to occur to carbonate aquifer groundwater as described for the No Action Alternative. However, in Section 5.23.2.2.1 (page 5-67) under the No Action Alternative it states that significant cumulative impacts could potentially occur to groundwater. This inconsistency should be clarified and a supporting analysis provided.	Sections 5.23.2.5.1 and 5.23.2.5.2 have been revised accordingly. The No Action Alternative would contribute no additional effects to groundwater if Section 10 permits were not issued. However, depending upon the specifics of future projects in terms of total water removed and pumping levels if permitted, the carbonate and alluvial aquifers present under private lands in southeastern Lincoln County could be affected. Implementation of the Preferred Alternative combined with the other plans and projects in the cumulative analysis area could result in significant impacts to groundwater.
NDOW	1 (D. Hardenbrook 2/17/09)	1	1.4.11.2			Any movement or take of tortoise requires valid state authorization (NRS 503.597).	Text has been revised in Section 1.4.11.2 of the EIS to read, "NRS Section 503.597 specifically states that it is unlawful to transport a desert tortoise within the state or across state lines, without the written consent of NDOW. Nevada does not have any laws that regulate the degradation of tortoise habitat."
NDOW	2 (D. Hardenbrook 2/17/09)	3	3.2.2.2.1		UPRR Activities	Will UPRR work closely with state and federal partners to allow access for monitoring important wildlife habitats in Meadow Valley Wash as part of the EIS/HCP	UPRR must limit access to the right-of-way to ensure railroad and public safety. As described in Section 5.3.5.2.1 and 6.7.2.2 of the SLCHCP, UPRR requests take of all suitable southwestern willow flycatcher habitat (up to 54 acres) within its right-of-way. Mitigation for the loss of flycatcher habitat will occur outside of the UPRR right-of-way. One benefit of the SLCHCP is that important wildlife habitat will be provided outside of the right-of-way, which is subject to regular and often significant disturbance necessary to carry out UPRR construction maintenance and operation activities. Thus, these measures will provide for longer term stability of habitat for the Covered Species and will provide for greater ease of monitoring the important habitats outside the right-of-way. USFWS will be provided reasonable access to lands covered under the HCP to ensure compliance with the HCP and incidental take permits.
NDOW	3 (D. Hardenbrook 2/17/09)	3	3.2.2.3.1		Conservation Measures for Land Dev. And Maint. Activities	Interim Measures – this section would seem to mirror that in the Coyote Springs HCP, the covered area having an impact area and recovery potential quite different from that presently addressed. In view of the low tortoise population density in the area where take will occur, a benefit/cost rationale demonstrating why an optional removal of tortoises out of harms way by short-distance translocation is not preferable over proposed mandatory clearance, processing and translocation (which is a lengthy and more costly process directing animals into research).	Although the efficacy of translocation itself has been questioned over the years, recent studies have shown initial success in translocation to be high (Field et al. 2007). Based on these studies and recommendations from the Desert Tortoise Recovery Office (DTRO) and desert tortoise biologists, translocation of tortoises has been identified as a recovery tool and included in the draft revised Recovery Plan for the Mojave Population of the Desert Tortoise (2008). The draft revised Recovery Plan for the Mojave Population of the Desert Tortoise maintains that an augmentation strategy would be developed. As part of this strategy, locally depleted or extirpated populations particularly within desert tortoise conservation areas will be identified. Translocation along with head-starting efforts would be used to augment depleted tortoise populations in conjunction with habitat restoration and management. In addition to translocation, other mitigation measures would be implemented as part of the SLCHCP.
NDOW	4 (D. Hardenbrook 2/17/09)	3		3-34	Habitat Restoration	The restoration <i>after</i> fire discussion is important and appreciated. Yet, another section addressing <i>fire prevention</i> with an educational component may be desirable.	Comment is acknowledged. Under proposed conservation measure "Public Education and Outreach" (refer to Section 3.2.2.3.1 of the EIS), a desert tortoise conservation effort proposed as part of the SLCHCP, the following bullet was added, "Educate developers, residents and visitors about the risk of fire and prevention measures."
NDOW	5 (D. Hardenbrook 2/17/09)	4	4.2.4.2		Other Wildlife	Terrestrial species presented in the document are some of the most common. NDOW provided suggested additions (see memo).	Text has been revised in Section 4.2.4.2 of the EIS to include additional species found within southeastern Lincoln County, such as the desert pocket mouse, ringtail, pinyon jay, loggerhead shrike, sage sparrow, desert night lizard, desert iguana, striped whipsnake, and common kingsnake
NDOW	6 (D. Hardenbrook 2/17/09)	4		4-12	Lowland Riparian	Please add coyote willow (<i>Salix exigua</i>)	Text has been revised in Section 4.2.4.3 of the EIS to include coyote willow (<i>Salix exigua</i>).

Response to Public Comments on Draft EIS for the SLCHCP Project

Agency	EIS Comment #	Section	Subsection	Page	Paragraph, Sentence	Comment	Response
NDOW	7 (D. Hardenbrook 2/17/09)	4		4-27	Ecologically Critical Areas	NDOW has records of several other prominent terrestrial species in Meadow Valley Wash inclusive of Gila monster (state protected), loggerhead strike (state sensitive) and several bats that are state protected and/or sensitive. Please review NAC 503.030 through 503.080 for a complete accounting of all aquatic and terrestrial wildlife.	Text has been revised in Section 4.2.9 of the EIS to include additional terrestrial species that inhabit the Meadow Valley Wash, such as state protected Gila monster (<i>Heloderma suspectum</i>), and state sensitive loggerhead strike (<i>Lanius ludovicianus</i>).
Center for Biological Diversity	2 (R. Mrowka 2/11/09)	4	4.2.4.1.2			It is highly questionable why some of the species listed in this section were not included in the Covered Species list, such as: Virgin River chub, MVW desert sucker and speckled dace, yellow-billed cuckoo, Yuma clapper rail, Arizona toad, threecorner milkvetch, sticky buckwheat, and Las Vegas buckwheat. The assertions pertaining to protection of species of concern in the DEIS such as, "The BLM would continue implementing their land use plan as funding and staffing is available," is not reassuring. The Center requests that all the species be added to the list of Covered Species in the HCP and sufficiently analyzed as to the impacts from the Covered Activities.	In the development of the SLCHCP, the applicants worked with the USFWS to select the federally-listed species for which they desire coverage. The applicants are seeking individual Section 10 incidental take permits for desert tortoise and southwestern willow flycatcher as part of the SLCHCP because those are the only species for which the applicants determined that they needed take authorization in order for them to implement their Covered Activities.
Center for Biological Diversity	4 (R. Mrowka 2/11/09)					The USFWS errors by wrongly assuming that the impacts to dry washes from the preferred alternative (proposed action) will be analyzed and addressed under the Section 404 permitting process. The case Southwest Center for Biological Diversity v. Bartel and recent internal directives issued by the EPA and the Army Corps of Engineers clearly demonstrates the lack of certainty involved with this assumption and hence leaving the impacts potentially unaddressed. It is inappropriate for the USFWS to issue an ITP(s) while deferring to further federal permitting and consultation requirements that may or may not occur. The concern is particularly troublesome where the ACOE jurisdiction is in doubt, such as Covered Activities in the LCLA and Section 36 areas, where perennial flows are lacking in the desert washes, and regarding the down-gradient impacts to aquatic and riparian species in Meadow Valley Wash and Muddy and Virgin Rivers. The Center requests that the USFWS strengthen and expand the analysis in the EIS to address the impacts from land development and other Covered Activities on desert washes and the species and habitats that will be impacted by such disturbances, rather than relying on uncertain future consultations under the CWA or Section 7 of the ESA.	The SLCHCP does not authorize any activity that would result in a discharge of dredged or fill material that requires a permit under Section 404 of the Clean Water Act. Rather, the SLCHCP merely provides a streamlined ESA Section 7 consultation mechanism whereby certain activities that require 404 permits and, in turn, require consultation with USFWS pursuant to ESA Section 7, may rely on the SLCHCP's analysis of impacts on Covered Species, provided that the Covered Activities and the impacts on the Covered Species are within the scope of the SLCHCP. Incidental take coverage under the SLCHCP would only be available pursuant to this streamlined Section 7 consultation mechanism if all conditions of the SLCHCP are met and the Covered Activities are carried out specifically as described in the SLCHCP. The analysis of the potential down-gradient impacts to aquatic and riparian species in Meadow Valley Wash and Muddy and Virgin Rivers from land development activities and other activities is provided in Section 5.4.2.1.3 of the EIS.
Center for Biological Diversity	6 (R. Mrowka 2/11/09)					The DEIS fails to provide an adequate analysis of mitigation measures for the HCP's environmental impacts. The DEIS must discuss mitigation in sufficient detail to ensure that environmental consequences have been fairly evaluated. USFWS makes no attempt to base the desert tortoise two-tier impact fee structure on the actual mitigation needs of the desert tortoise, rather arbitrarily restricts it to the highest fee allowed under the Nevada Revised Statutes. This makes little sense, for the conservation of the tortoise, the fee should be based on the amount of funding needed to adequately mitigate for the loss of habitat under the HCP and ITP. The recently approved Lincoln County Coyote Springs HCP, which borders the Covered Area for this HCP, imposes a mitigation fee of \$800 per acre. Also, desert tortoise translocation is an experimental procedure that should not be used as a mitigation strategy. Likewise, mitigation fees and measures for the southwestern willow flycatcher are unsupported or explained. While the proposed mitigation fee of \$12,000 per acre is seemingly significant, the USFWS failed to show that this amount will be enough to adequately acquire sites and restore flycatcher habitat. Rather, it appears that an arbitrary fee was selected without reference to the actual cost of acquisition of land or work required. Thus, the Center requests that the EIS provide better documentation of the rationale and justification for the mitigation fees selected and for the amount of restoration work required to mitigate for the Covered Activities.	Total fees to be collected by Lincoln County are based upon the amount of funding USFWS has determined is needed to adequately mitigate for the loss of desert tortoise and southwestern willow flycatcher habitat and the potential effects of incidental take on the Covered Species under the SLCHCP and related incidental take permit. The following mitigation measures will be implemented by the permittees as a condition of the SLCHCP in order to fulfill the statutory criteria for issuing a Section 10 permit, also summarized in Section 3.2.2.3.7 of the EIS. In summary, for the desert tortoise, each permittee will pay, or caused to be paid, a per-acre fee of either \$250 or \$550 (based on specific geographic area within the Covered Area, refer to Section 6.3.2.1 in the HCP) for disturbance to desert tortoise habitat. The mitigation fee will be imposed on all Covered Activities resulting in land disturbance on private lands within the Covered Area and will be paid at the time of issuance of the Section 10 permit or prior to carrying out the Covered Activity that results in land disturbance. A mitigation fee of \$550/acre is the maximum allowable mitigation fee that Lincoln County can impose pursuant to NRS Chapter 349 for desert tortoise habitat disturbance; however, Lincoln County has established a General Improvement District (GID) and related property tax revenue stream (refer to Section 9.1.1.3 in the HCP) to supplement legislatively authorized and capped per-acre desert tortoise fees to ensure that the necessary funding is provided to implement the proposed conservation measures. The total fees generated (refer to Table 3-4 in the EIS) will be used toward the implementation of the following desert tortoise conservation efforts to offset all potential effects anticipated from the Covered Activities: Head Start Program for the desert tortoise, Translocation Program for the desert tortoise, Fund Research of the Ecological Implications of Fire, Other Applied Research, Habitat Restoration, Public Education and Outreach, Implementation of the LCLA Road, Fence and Trail Plan, and Predator Monitoring Control. The development, design, timing and implementation of these actions will be accomplished as part of the mitigation plan prescribed for the SLCHCP by the IMC during the first year of implementation of the SLCHCP. Implementation of these mitigation measures will occur commensurate with the timing of anticipated take associated with the loss of habitat so as to ensure adequate and timely mitigation for impacts associated with habitat loss and to ameliorate disturbances directly or indirectly resulting from the Covered Activities on the species. In summary, for the southwestern willow flycatcher, each permittee will pay a per-acre fee of \$12,000 for suitable flycatcher removed. The mitigation fee of \$12,000 per acre for loss of suitable flycatcher habitat was derived from known costs of other riparian restoration projects occurring within the western and southwestern United States (refer to Section 6.5.1.2 in the HCP). The contribution of funds (refer to Table 3-4 in the EIS) collected by Lincoln County from permittees whose activities affect southwestern willow flycatcher within the Covered Area over the 30-year permit term will be used to cover costs of flycatcher restoration elsewhere along the Meadow Valley Wash, either through creation of existing suitable habitat on BLM-administered or private land and/or protection of existing suitable habitat on private land through acquisition of conservation easements. All habitat created would be managed by Lincoln County as a habitat bank. A restoration and management strategy for the conservation of flycatcher habitat in the Meadow Valley Wash is currently being developed by the permittees. Implementation of these mitigation measures will occur commensurate with the timing of anticipated take associated with the loss of habitat so as to ensure adequate and timely mitigation for impacts associated with habitat loss and to ameliorate disturbances directly or indirectly resulting from the Covered Activities on the species. The commenter refers to the recently approved Coyote Springs Investment (CSI) MSHCP in which disturbance fees of \$800 per acre are assessed. It is important to note that the entire acreage covered under the CSI MSHCP is desert tortoise critical habitat, whereas the Covered Area for the SLCHCP includes no critical habitat for the southwestern willow flycatcher and a small acreage (approximately 246 acres) of critical habitat for the desert tortoise in the Mormon Mesa Critical Habitat Unit along the Lower Meadow Valley Wash. Approximately 2 miles (60 acres) of UPRR's right-of-way traverses designated desert tortoise habitat within the Mormon Mesa Critical Habitat Unit in the HCP Covered Area: within the 60 acres of right-of-way in this two-mile stretch, 36 acres are previously disturbed, leaving only 24 acres that are relatively undisturbed.

Response to Public Comments on Draft EIS for the SLCHCP Project

Agency	EIS Comment #	Section	Subsection	Page	Paragraph, Sentence	Comment	Response
Center for Biological Diversity	7 (R. Mrowka 2/11/09)					The USFWS has erred in the DEIS by largely isolating from consideration in this document the findings of the NSE in Ruling 5181, dated November 26, 2002, pertaining to the Tule Desert Hydrographic Basin. USFWS has failed to adequately consider and address the cumulative effects of the water withdrawals necessitated by the development.	It is important to note that the development of the LCLA lands is anticipated to occur over a 30-year period. The project development schedule and the extent of building will be limited by the water supply that is available to the GID for serving the customers within its service territory (the development area). Development will occur over time and the water supply will be obtained in phases during the course of development. This is the normal process for developing a community and its associated water right entitlement. Before water is ultimately delivered to developments within the Covered Area, those seeking the water will have to comply with all applicable state and federal laws. Cumulative impacts to water withdrawals are addressed in the EIS (refer to Section 5.23.2.5). Any further discussion at this time would be purely speculative.
EPA	1 (K. Goforth 2/18/09)				Impacts to Covered Species	The DEIS does not sufficiently demonstrate how the conservation measures will protect, conserve and enhance the Covered Species populations and their habitats from impacts resulting from the Covered Activities. The DEIS does describe take of acres of Covered Species habitat but does not provide baseline population data for the Covered Species. We recommend that the FEIS include this information as well as estimate take of Covered Species individuals. Information on baseline populations and take of individuals would help clarify impacts of activities covered under the HCP and provide important information for determining the effectiveness of the conservation measures on Covered Species populations.	Refer to the response to EIS Comment #6 by the Center for Biological Diversity on how the conservation measures to be implemented by the permittees as a condition of the SLCHCP will offset the potential effects to the Covered Species from the Covered Activities. Species status data for the desert tortoise (rangelwide and within the Covered Area) and for the southwestern willow flycatcher (rangelwide and within the Covered Area) are provided in Sections 3.2.8.1 and 3.3.7.1 of the SLCHCP, respectively. The Section 7 biological opinion (BO) will further discuss baseline and anticipated take of the Covered Species.
EPA	2 (K. Goforth 2/18/09)				DT Conservation Measures	EPA remains concerned with the proposed translocation program, habitat restoration, and other proposed measures. EPA recommends the FEIS discuss the proposed translocation program in light of the challenges faced at Fort Irwin and clarify how these challenges will be addressed in the Covered Area. EPA also recommends that the FEIS describe how the USFWS will ensure that the proposed native revegetation restoration program will be successful, and describe how non-native vegetation seed contamination will be prevented. EPA also recommends clarifying information regarding the handling of desert tortoise and including a commitment to identify priority locations in the Covered Area where desert tortoise-proof fencing should be implemented to prevent vehicle impacts on roadways.	Comment is acknowledged about desert tortoise-proof fencing. Although the efficacy of translocation itself has been questioned over the years, recent studies have shown initial success in translocation to be high (Field et al. 2007). Based on these studies and recommendations from the DTRO and desert tortoise biologists, translocation of tortoises has been identified as a recovery tool and included in the draft revised Recovery Plan for the Mojave Population of the Desert Tortoise (2008). The draft revised Recovery Plan for the Mojave Population of the Desert Tortoise maintains that an augmentation strategy would be developed. As part of this strategy, locally depleted or extirpated populations particularly within desert tortoise conservation areas will be identified. Translocation along with head-starting efforts would be used to augment depleted tortoise populations in conjunction with habitat restoration and management. Under the SLCHCP, approximately \$4,000,000 in funding will be provided either to BLM or third party contractor to purchase native seed and to enhance at least 5,120 acres of desert tortoise habitat associated with recently burned areas in the Covered Area. Additional conservation efforts to be funded by the SLCHCP for the desert tortoise include assistance with the Desert Tortoise Head Start Program (including translocation), research efforts, public outreach and education, implementation of the LCLA Road, Fence and Trail Plan, and predator monitoring and control (refer to Section 6.3.2.1.1 in the SLCHCP).
EPA	3 (K. Goforth 2/18/09)				SWWF Conservation Measures	EPA recommends the USFWS and applicants commit to creating a riparian mitigation/conservation bank as soon as possible. EPA suggests using the \$1.1M from UPRR to create a mitigation/conservation bank as early as possible. The FEIS should include a figure that clearly illustrates UPRR impacts to riparian habitat and the USFWS should commit to not approving UPRR's Covered Activities that would impact riparian mitigation areas in Meadow Valley Wash that are required by the pending EPA enforcement case against UPRR. EPA also recommends revising the conservation measures for avoiding impacts to SWWF, during UPRR activities, to provide better protection during non-emergency activities.	The SLCHCP is designed to allow flexibility in finding means to satisfy its mitigation obligations. While a conservation bank is an excellent tool that can be used for this purpose, we recognize there are a variety of methods that can be useful for protecting habitat. The SLCHCP is not limited to the use of formal conservation banks. The applicants will be required to mitigate for all of the suitable habitat they remove, and will use the most appropriate and effective method available for securing and protecting mitigation sites. The SLCHCP does show where potential southwestern willow flycatcher habitat is located within the UPRR right-of-way, and the USFWS believes that the conservation measures outlined in the SLCHCP for UPRR adequately minimize impacts to the southwestern willow flycatcher during emergency and non-emergency activities. The HCP would not affect actions required by EPA's enforcement case.
EPA	4 (K. Goforth 2/18/09)				WOUS	The FEIS should include additional information on how the HCP would streamline future Section 7 consultations. It is not clear how the HCP intends to provide a mechanism to streamline future Section 7 consultations, essentially how this process would work and how adequate mitigation for impacts to the Covered Species would be guaranteed. It would be useful to the reader if the FEIS included an example of a potential 404 activity that could be expected to occur in the Covered Area, how the HCP might then streamline the Section 7 Consultation, and how the mitigation measures would be assessed.	The SLCHCP does not authorize any activity that would result in a discharge of dredged or fill material that requires a permit under Section 404 of the Clean Water Act. Rather, the SLCHCP merely provides a streamlined ESA Section 7 consultation mechanism whereby certain activities that require 404 permits and, in turn, require consultation with USFWS pursuant to ESA Section 7, may rely on the SLCHCP's analysis of impacts on Covered Species, provided that the Covered Activities and the impacts on the Covered Species are within the scope of the SLCHCP. Incidental take coverage under the SLCHCP would only be available pursuant to this streamlined Section 7 consultation mechanism if all conditions of the SLCHCP are met and the Covered Activities are carried out specifically as described in the SLCHCP.
EPA	5 (K. Goforth 2/18/09)				Groundwater	The EPA is concerned with the lack of strong water conservation language in the DEIS and recommends the Lincoln County Development Agreement be revised to include stronger language to address this issue. Such language could include, for example, requirements that treated effluent be used for irrigation of golf courses, public/commercial landscaping, industrial processes, and toilet flushing; and the installation of water-efficient toilets and appliances.	Comment is acknowledged. Inclusion of specific language in the Lincoln County Development Agreement is outside the scope of the EIS for this project. However, the final development agreements adopted by Lincoln County address the concerns raised by EPA in this comment.
EPA	6 (K. Goforth 2/18/09)				Purpose and Need	The FEIS should clarify how the HCP will not conflict with internal Service consultation requirements related to destruction or modification of critical habitat.	No critical habitat is designated for the southwestern willow flycatcher in the Covered Area. There are 246 acres of private lands within the Mormon Mesa Critical Habitat Unit for desert tortoise in the Covered Area. There are no known plans for changing the current land use within these parcels except for up to 60 acres, which could potentially be disturbed by UPRR activities. Within the 60 acres or approximately 2 miles of UPRR's right-of-way that traverses designated desert tortoise critical habitat within the Mormon Mesa Critical Habitat Unit, 36 acres are previously disturbed; leaving only 24 acres that are relatively disturbed (refer to Section 5.9.2 in the EIS). The USFWS will ensure compliance with its procedures for addressing adverse effects on critical habitat in their biological opinion and ensure consistency with consultation procedures with other agencies.
EPA	7 (K. Goforth 2/18/09)				Alternatives	The FEIS should explain why the DEIS did not consider an alternative that creates new conservation areas for the Covered Species, such as a land acquisition alternative.	A land acquisition alternative was not considered feasible because land acquisition opportunities are extremely limited in Lincoln County due to the fact that the majority of land in Lincoln County (98%) is federally-owned and not available for purchase. Most of the land to be covered by the SLCHCP incidental take permits is former BLM land that was congressionally conveyed for the sole purpose of economic growth in a county that has very little private land. Therefore, the best conservation opportunities in Lincoln County are on lands managed by the BLM. However, the HCP does provide measures to minimize effects to the Covered Species on the non-Federal lands that will be covered by the ITPs.
EPA	8 (K. Goforth 2/18/09)				Climate Change	The FEIS should include an expanded discussion of anticipated impacts of climate change on the Covered Species, how these impacts will be identified and managed, and how the Adaptive Management Plan will ensure that conservation measures are designed to help offset these impacts. Consider a species distribution model as a tool to better understand how to manage for climate change.	Potential cumulative effects to the desert tortoise and other wildlife species occurring within and/or adjacent to the Covered Area from drought and other climatic variations due to climate change are discussed in Sections 5.23.2.1.1 and 5.23.2.3.1, respectively in the EIS.

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NDOW	1 (D. Hardenbrook 2/17/09)	1	1.2.12	1-14	Nevada Revised Statutes	Any movement or take of tortoises requires valid state authorization (NRS 503.597).	Text has been revised in Section 1.2.12 of the HCP to read, "NRS Section 503.597 specifically states that it is unlawful to transport a desert tortoise within the state or across state lines, without the written consent of NDOW. Nevada does not have any laws that regulate the degradation of tortoise habitat."
NDOW	2 (D. Hardenbrook 2/17/09)	2	2.1.6.1	2-4	Lowland Riparian	Please add coyote willow (<i>Salix exigua</i>).	Text has been revised in Section 2.1.6.1 of the HCP to read, "...Fremont cottonwood (<i>Populus fremontii</i>), Goodding's black willow (<i>Salix gooddingii</i>), coyote willow (<i>Salix exigua</i>), honey mesquite (<i>Prosopis glandulosa</i>)..."
NDOW	3 (D. Hardenbrook 2/17/09)	2	2.1.6.2	2-4	Fish and Wildlife	Please note suggested species additions from the Draft EIS Section 4.2.4.2.	Text has been revised in Section 2.1.6.2 of the HCP to include additional species found within the Covered Area such as the desert pocket mouse, ringtail, pinyon jay, loggerhead shrike, sage sparrow, desert night lizard, desert iguana, striped whipsnake, and common kingsnake.
NDOW	4 (D. Hardenbrook 2/17/09)	3	3.2.5.4 Nevada	3-5	Inadequate Reg. Mechanisms, NV	The 3 rd sentence is an incorrect statement and reflects NAC classification and context from the early 1990s. Current State of Nevada classification has desert tortoise as Protected and Threatened (NAC 503.080). It may be worthwhile to consult the Nevada Law Library online at http://leg.state.nv.us/law1.cfm for checking accuracy of the applicable NRS' and NAC's presented elsewhere.	Text has been revised in Section 3.2.5.4 of the HCP read, "Section 503.080.2 of the NAC classifies desert tortoise as threatened outside the urban areas of Clark County (Las Vegas).
NDOW	5 (D. Hardenbrook 2/17/09)	3	3.3.3.1	3-26	Habitat	In Nevada, southwestern willow flycatchers also nest in coyote willow (<i>Salix exigua</i>).	Text has been revised in Section 3.3.3.1 of the HCP to read, "...Goodding's willow (<i>Salix gooddingii</i>), coyote willow (<i>Salix exigua</i>), boxelder (<i>Acer negundo</i>)..."
NDOW	6 (D. Hardenbrook 2/17/09)	6	6.3.1.1.1		Interim Measures – DT Clearance Surveys, Process and Transport	Again, desert tortoise head-start and translocation efforts may not be warranted for this area as previously discussed. And, there appears to be quite a bit of borrowing from the Coyote Springs HCP/EIS which is an entirely different situation. It is unclear why writers of the HCP are suggesting spending so much time, effort and ultimately money on clearance surveys, head-starting programs, processing via genotyping and disease testing, subsequent translocation and all associated costs of transporting and caring for the tortoises where investment returns are anticipated to be low. In some cases tortoises could be moved out of harms way and remain in the wild consequential to short-distance translocation provided pre-determined areas for releases are identified and the habitat is of quality where tortoises would likely survive. Additional discussion is desired on this aspect.	Although the efficacy of translocation itself has been questioned over the years, recent studies have shown initial success in translocation to be high (Field et al. 2007). Based on these studies and recommendations from the Desert Tortoise Recovery Office (DTRO) and desert tortoise biologists, translocation of tortoises has been identified as a recovery tool and included in the draft revised Recovery Plan for the Mojave Population of the Desert Tortoise (2008). The draft revised Recovery Plan for the Mojave Population of the Desert Tortoise maintains that an augmentation strategy would be developed. As part of this strategy, locally depleted or extirpated populations particularly within desert tortoise conservation areas will be identified. Translocation along with head-starting efforts would be used to augment depleted tortoise populations in conjunction with habitat restoration and management. In addition to translocation, other mitigation measures would be implemented as part of the SLCHCP.
NDOW	7 (D. Hardenbrook 2/17/09)	6	6.3.1.1.2		Construction BMPs	The NDOW would like further discussion as to why the BMPs presented are necessary in view that the LCLA is in low density tortoise habitat; could an alternative set of BMPs reflect what might be a more appropriate methodology? The NDOW looks forward for additional discussion prior to release of the final HCP/EIS.	The BMPs build in assurances and are appropriate to minimize and mitigate impacts to the desert tortoise from construction activities on LCLA lands per issuance criteria of Section 10(a)(1)(B).
NDOW	8 (D. Hardenbrook 2/17/09)	6	6.3.1.1.3		Long Term Measures, LCLA Das	Given that the LCLA is not presently developed from urbanization, NDOW is supportive of prohibiting pet tortoises in the new community.	Comment is acknowledged.
NDOW	9 (D. Hardenbrook 2/17/09)	6	6.3.2.1.1		DT Conservation Efforts, Head-start Program	This section takes the recovery plan and tries to apply logic of range-wide threats to a low density tortoise area that is for the most part intact, open public land with limited data on population trends and needs. Is this prudent?	Updated baseline information for the desert tortoise consisting of data from recent surveys conducted in the Covered Area will be included in the Final SLCHCP and are reflected in Section 3.2.8.3 of the HCP.
NDOW	10 (D. Hardenbrook 2/17/09)	6			Translocation	Has there been an identified need in the Covered Area for translocation based on population declines not attributable to natural limiting factors of the habitat (marginal vs. high quality) or other habitat related events affecting carrying capacity like prolonged drought, wildfire or fragmentation/degradation attributable to past land uses. Is there data suggesting the Covered Area has the carrying capacity to accommodate purposeful tortoise translocation?	No data currently exists that would suggest the carrying capacity can or cannot accommodate tortoise translocation, which is why the DTRO does not recommend moving displaced tortoises from urban development in the Covered Area into adjacent habitat. Holding displaced tortoises at the Desert Tortoise Conservation Center (DTCC) will allow time to determine the best strategy for using tortoises for conservation and recovery purposes, whether that would be relocating tortoises into adjacent habitats in the Covered Area or elsewhere.
NDOW	11 (D. Hardenbrook 2/17/09)	6		6-19	Last paragraph	Rigor going into "one-time" surveys is unclear, and there is a possibility brief efforts would not necessarily document habitat occupied by southwestern willow flycatchers. Please provide perspective as to why only "a few areas of suitable...." habitat would be surveyed?	Based on existing data for the Meadow Valley Wash, the flycatcher population is very low, and thus the chance of encountering and disturbing nesting flycatchers in the Meadow Valley Wash is equally as low. Based on data from past surveys, encounters with nesting flycatchers are more likely to occur only in certain specific locations. It is these specific locations that UPRR will survey for flycatchers prior to habitat disturbing activities. It is then assumed that the habitat will be removed and maintained at a stage that will no longer function as suitable or potentially suitable habitat; therefore, additional flycatcher surveys in these same locations should not be needed.
NDOW RECOMMENDATIONS							
NDOW						NDOW recommends mitigation efforts for desert tortoise prioritize invasive species and fuels management along with disturbed habitat restoration and greatly de-emphasize mandatory collection of desert tortoises from private lands and head-start / translocation efforts until there is demonstrated need to augment populations as demonstrated by long-term declines in the Covered Area. Opportunities to attend to head-start and translocation efforts under other HCP-funded permits and programs exist. Additionally, present activities and lessons learned related to mandatory collection, head-start and translocation programs have proven logistically problematic, become costly and have not met intended long-term recovery goals and objectives. The present effort would be better served by identifying applied habitat actions, monitoring and research detailing the dynamics of declines in the Covered Area, and pursuit of actions moving to ameliorate the declines prior to any head-start and translocation programs.	We agree this is a priority but will be addressed in project-specific cooperative agreements between the County and BLM.

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Center for Biological Diversity	1 (R. Mrowka 2/11/09)					USFWS has failed to adequately analyze and disclose the multiple impacts to desert tortoise and its habitat in the Covered Area and in the context of the Northwestern Mojave Desert Tortoise Recovery Unit, primarily because the HCP contains inadequate and incomplete baseline, survey, and reserve data. Take estimates and impacts are not quantified because the HCP did not conduct a comprehensive inventory or analysis of the impacts from private or municipal development on up to 30,673 acres. Nor has it placed the loss from Covered Activities in the Covered Area into the context of the entire Recovery Unit. Therefore, USFWS has failed to provide the assurance that the recovery of desert tortoise will not be hindered by the issuance of the ITP(s) sought through this HCP.	The USFWS is required to conduct an internal formal consultation under Section 7 of the ESA on the Federal action of issuance of the incidental take permit(s). The ITPs would only be issued if the USFWS's biological opinion includes a determination that the permit issuance would not appreciably reduce the likelihood of survival and recovery of listed species (i.e., desert tortoise and southwestern willow flycatcher). The USFWS has been working closely with the applicants since 2001 (inception of the project) to develop conservation measures that will adequately minimize and mitigate impacts to listed species. Jeopardy to the species and adverse modification to critical habitat are evaluated through the biological opinion written by the USFWS for the issuance of the ITP. Updated baseline information for the desert tortoise consisting of data from recent surveys conducted in the Covered Area will be included in the Final SLCHCP and are reflected in Section 3.2.8.3 of the HCP.
Center for Biological Diversity	2 (R. Mrowka 2/11/09)					The list of Covered Species is far too narrow. There is no rational basis for excluding many of the listed species and state protected species that the USFWS identifies as being adjacent to the Covered Area.	In the development of the SLCHCP, the applicants worked with the USFWS to select the federally-listed species for which they desire coverage. The applicants are seeking individual Section 10 incidental take permits for desert tortoise and southwestern willow flycatcher as part of the SLCHCP because those are the only species for which the applicants determined that they needed take authorization in order for them to implement their Covered Activities.
Center for Biological Diversity	3 (R. Mrowka 2/11/09)		4.1.4.2 (HCP)	4-11 (HCP) 1-5 (DEIS) 3-13 (DEIS)		The disposition of the Section 36, proposed Toquop coal-fired power plant site (Section 36) with regards to "take" and coverage under the HCP and requested incidental take is murky at best. Section 9 of the HCP, Funding, is of no help in determining if the proposed mitigation fee will be applied against the Section 36 acres. The Center is adamantly opposed to including the Section 36 site as a Covered Activity under this HCP and ITP(s). Nowhere in the HCP/DEIS has the USFWS revealed the impacts to the proposed Covered Species and their habitats. As such, references to Section 36 being a Covered Activity under this HCP should be removed, and once privatized, "take" should be authorized under a separate Section 10 incidental take permit.	Section 36 has been identified by BLM in the recently completed Final RMP/EIS for the Ely District as suitable for disposal. Section 36 is crossed by existing 500 kv electrical transmission lines and existing natural gas pipeline. The parcel is accessible by existing roads from I-15. Lincoln County intends that Section 36 be developed for industrial purposes. However, the SLCHCP is not covering the operation and maintenance of the coal-fire powered plant. A separate Section 7 BO has been issued for disposal of the land and operation of the coal-fire powered plant. Since there is no certainty that Section 36 will be developed for a coal-fired power plant, Lincoln County is proposing to include the parcel in the event the parcel becomes available for other types of development consistent with the Covered Activities described in the HCP.
Center for Biological Diversity	5 (R. Mrowka 2/11/09)					The USFWS inappropriately intends to institute a "No Surprises" clause to this HCP, which will lead to inadequate assurances for the survival and recovery of the Covered Species. The "No Surprises" rule has been in almost continuous litigation from its inception and has been revised several times. The HCP's Adaptive Management program is insufficient to protect species from harm in the future if the MSCHP does not prove to adequately protect species survival and recovery and to require additional measures be taken for such protections in the face of changed circumstances or relevant new information. Therefore, the HCP must not include this illegal provision.	Although the "No Surprises" rule (50 CFR 17.22(b)(5) and 17.32(b)(5)) has been subject of litigation, it remains a valid USFWS policy. The adaptive management program (described in Section 7.3 of the HCP) will use the Annual Work Plan process (described in Section 8.1.2.2) as the framework for ensuring that projects to be funded are providing the level of conservation needed to meet the goals and objectives of the HCP. Through the development of an Annual Work Plan, funding may be shifted from year to year among different projects depending on project priority, success of previously funded projects, and the need to respond to changed circumstances should they occur. The process for responding to changed circumstances is described in Section 8.3 of the HCP. Project success will be determined by monitoring how well conservation actions are meeting the goals and objectives of the HCP. This will ensure that the highest priority projects with the greatest success will be funded. In this regard, we believe that the adaptive management program provides assurances that the Covered Species will be adequately protected under the HCP.
Center for Biological Diversity	6 (R. Mrowka 2/11/09)					The Conservation Measures are inadequate and incomplete, and the USFWS fails to provide the necessary documentation and rationale for the proposed mitigation fees. If USFWS grants a permit on the basis of this HCP without requiring additional minimization and mitigation measures for impacts to the Covered Species, it will be in violation of its duties under Sections 2 and 7 of the ESA. As it stands, the HCP does not demonstrate that it prevents jeopardy (survival and recovery) and adverse modification.	The following mitigation measures will be implemented by the permittees as a condition of the SLCHCP in order to fulfill the statutory criteria for issuing a Section 10 permit, also summarized in Section 6.9 of the HCP. In summary, for the desert tortoise, each permittee will pay, or caused to be paid, a per-acre fee of either \$250 or \$550 (based on specific geographic area within the Covered Area, refer to Section 6.3.2.1) for disturbance to desert tortoise habitat. The mitigation fee will be imposed on all Covered Activities resulting in land disturbance on private lands within the Covered Area and will be paid at the time of issuance of the Section 10 permit or prior to carrying out the Covered Activity that results in land disturbance. A mitigation fee of \$550/acre is the maximum allowable mitigation fee that Lincoln County can impose pursuant to NRS Chapter 349 for desert tortoise habitat disturbance; however, Lincoln County has established a General Improvement District (GID) and related property tax revenue stream (refer to Section 9.1.1.3) to supplement legislatively authorized and capped per-acre desert tortoise fees to ensure that the necessary funding is provided to implement the proposed conservation measures. The total fees generated (refer to Table 9-6 in the HCP) will be used toward the implementation of the following desert tortoise conservation efforts to offset all potential effects anticipated from the Covered Activities: Head Start Program for the desert tortoise, Translocation Program for the desert tortoise, Fund Research of the Ecological Implications of Fire, Other Applied Research, Habitat Restoration, Public Education and Outreach, Implementation of the LCLA Road, Fence and Trail Plan, and Predator Monitoring Control. The development, design, timing and implementation of these actions will be accomplished as part of the mitigation plan prescribed for the SLCHCP by the IMC during the first year of implementation of the SLCHCP. Implementation of these mitigation measures will occur commensurate with the timing of anticipated take associated with the loss of habitat so as to ensure adequate and timely mitigation for impacts associated with habitat loss and to ameliorate disturbances directly or indirectly resulting from the Covered Activities on the species. In summary, for the southwestern willow flycatcher, each permittee will pay a per-acre fee of \$12,000 for suitable flycatcher removed. The mitigation fee of \$12,000 per acre for loss of suitable flycatcher habitat was derived from known costs of other riparian restoration projects occurring within the western and southwestern United States (refer to Section 6.5.1.2 in the HCP). The contribution of funds (refer to Table 9-6 in the HCP) collected by Lincoln County from permittees whose activities affect southwestern willow flycatcher within the Covered Area over the 30-year permit term will be used to cover costs of flycatcher restoration elsewhere along the Meadow Valley Wash, either through creation of existing suitable habitat on BLM-administered or private land and/or protection of existing suitable habitat on private land through acquisition of conservation easements. All habitat created would be managed by Lincoln County as a habitat bank. A restoration and management strategy for the conservation of flycatcher habitat in the Meadow Valley Wash is currently being developed by the permittees. Implementation of these mitigation measures will occur commensurate with the timing of anticipated take associated with the loss of habitat so as to ensure adequate and timely mitigation for impacts associated with habitat loss and to ameliorate disturbances directly or indirectly resulting from the Covered Activities on the species. The USFWS is required to conduct an internal formal consultation under Section 7 of the ESA on the Federal action of issuance of the incidental take permit(s). The ITPs would only be issued if the USFWS's biological opinion includes a determination that the permit issuance would not appreciably reduce the likelihood of survival and recovery of listed species (i.e., desert tortoise and southwestern willow flycatcher). The USFWS has been working closely with the applicants since 2001 (inception of the project) to develop conservation measures that will adequately minimize and mitigate impacts to listed species. Jeopardy to the species and adverse modification to critical habitat are evaluated through the biological opinion written by the USFWS for the issuance of the

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							ITP.
Center for Biological Diversity	7 (R. M rowka 2/11/09)					The proposed HCP would encourage community and industrial development that would necessitate groundwater development leading to further threats to Covered Species and other species of concern. The USFWS fails to analyze the connected, cumulative and similar actions in and adjacent to the Covered Area, including those from climate change and desertification.	Analysis of cumulative effects on threatened and endangered species and other species of concern from future development and climate change are addressed in the cumulative effects Section 5.23.2 of the EIS.