

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**WELL WATER TESTING**

(No.)  
**CODE 355**

**DEFINITION**

Testing for physical, biological and chemical characteristics of well water.

**PURPOSE**

To determine the quality of a water supply for the intended use.

**CONDITIONS WHERE PRACTICE APPLIES**

This standard applies to water supplies that are used or have potential to be used on farms or ranches.

**CRITERIA**

The specific use of the water and the water quality concerns shall be identified.

The required tests and applicable standards shall be determined based on the planned use of the water.

Water samples shall be collected and analyzed in accordance with established procedures. The U.S. Geological Survey's [National Field Manual for the Collection of Water-quality Data](#): (U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9) is available online at <http://pubs.water.usgs.gov/twri9A>. Contact the testing entity for specific guidance.

Interpretation of test results and recommendations for remedial actions, as necessary, shall be obtained from a knowledgeable source appropriate to the test and purpose.

**CONSIDERATIONS**

The following items should be considered in planning water supply testing:

- Location and depth of supply, type of geology and history of site in relationship to sources of potential contamination such as surface water, septic system, chemical storage facilities, roads, and animal waste storage or treatment facility.
- Water supply construction practices used such as dug, drilled, casing, or spring development.

- Using a computerized total farm record- keeping system for ease of data input, analysis, and retrieval.
- Using a state certified lab. In California, the state Department of Health Services' Division of Laboratory Science administers the Environmental Laboratory Accreditation Program (ELAP). Accreditation is required of an environmental laboratory for producing analytical data for California regulatory agencies. The data may be used to demonstrate compliance with applicable requirements of drinking water, wastewater, food for pesticide residues, shellfish testing, and hazardous waste sections of the California Health and Safety and Water Codes. More information is available online at <http://www.dhs.ca.gov/ps/ls/elap/html/elapinfo.htm>.

**PLANS AND SPECIFICATIONS**

Plans and specifications for water testing shall be consistent with this standard to achieve the desired results.

Specify guidelines describing process of collection, storage, transport, testing and reporting.

**OPERATION AND MAINTENANCE**

Records on water testing information will include:

- Date water sample taken,
- Name and title of person who collected sample,
- Standard collection procedure followed,
- Water test analysis date,
- Laboratory used,
- Contaminants tested for,
- Schedule of additional testing at required frequency according to applicable standard,
- Records to evaluate trends and the effects of remedial action,
- Weather data, and
- Other records as required.

U.S DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE  
CALIFORNIA

**PRACTICE REQUIREMENTS  
FOR  
355 – WATER WELL TESTING**

For: Business Name \_\_\_\_\_  
Job Location \_\_\_\_\_  
County \_\_\_\_\_ RCD \_\_\_\_\_ Farm/Tract No. \_\_\_\_\_  
Referral No. \_\_\_\_\_ Prepared By \_\_\_\_\_ Date \_\_\_\_\_

**IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.**

Installation shall be in accordance with the following drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF THE NRCS TECHNICIAN.

1. Drawings, No. \_\_\_\_\_
2. Water Quality Concerns \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
3. Contaminants to be tested for \_\_\_\_\_
4. Special Requirements: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. Special Maintenance Requirements: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**PRACTICE APPROVAL:**

Job Classification: (Ref: Section 501 NEM)

Show the limiting elements for this job. This job is classified as, Class  V

Limiting elements:	Units
SCE Approval Required	
_____	_____
_____	_____
_____	_____

Design Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

**LANDOWNER'S/OPERATOR'S ACKNOWLEDGEMENT:**

The landowner/operator acknowledges that:

- a. He/she has received a copy of the drawings and specification, and that he/she has an understanding of the contents, and the requirements.
- b. He/she has obtained all the necessary permits.
- c. No changes will be made in the installation of the job without prior concurrence of the NRCS technician.
- d. Maintenance of the installed work is necessary for proper performance during the project life.

Accepted by: \_\_\_\_\_ Date: \_\_\_\_\_

**PRACTICE COMPLETION:**

I have made an on site inspection of the site (or I am accepting owner/contractor documentation), and have determined that the job as installed does conform to the drawings and practice specifications.

Completion Certification by:

/s/ \_\_\_\_\_ Date \_\_\_\_\_

United States Department of Agriculture  
Natural Resources Conservation Service

**STATEMENT OF WORK**  
**Well Water Testing (355)**

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**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

**Items marked with an asterisk (\*) will be delivered to the Designated Conservationist**

**DESIGN**

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**Deliverables:**

1. Documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan.
  - b. List of required permits to be obtained by the client.
  - c. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. List of Methods/Procedures of Water Testing
    - ii. The Name of State Certified Laboratory Conducting the Testing
    - iii. Identify specific use of water or concerns
    - iv. Environmental Considerations (e.g. water quality)
2. Written plans including sketches and drawings shall be provided to the client that adequately describes the location and time of water samples taken.

**INSTALLATION**

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**Deliverables**

1. Pre-sampling conference with client and contractor.
2. Verification that client has obtained required permits.
3. Facilitate and implement required testing plan modifications with client and original planner.
4. **\*Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.**
5. **\*Certification that the water testing was conducted by a State Certified Laboratory.**

**CHECK OUT**

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**Deliverables**

1. **\*Date, time, location of water testing. Methods used for water sampling.**
2. **\*Date, time of water test analysis, Contaminants tested for.**
3. **\*Laboratory identification and certification.**
4. **\*Test results and interpretations.**

**REFERENCES**

- 
- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Well Water Testing, Code 355.
  - Private Water Systems Handbook. Handbook 14. Mid West Plan Service MWPS, Ames, IA. 4th edition, 1979
  - U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, available online at <http://pubs.water.usgs.gov/twri9A>.

**STATEMENT OF WORK**  
**Anaerobic Digester, Ambient Temperature (365)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

## **DESIGN**

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### **Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
  - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Geology and Soil Mechanics (NEM Subpart 531a)
    - ii. Storage Volume
    - iii. Structural, Mechanical and Appurtenance design
    - iv. Environmental Considerations (e.g. air quality, bio-security)
    - v. Safety Considerations (NEM Part 503-Safety, Subpart A, 503.10 through 503.12)
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describe the requirements to install the practice and obtain necessary permits..
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (b) (2))
6. Design modifications during installation as required

## **INSTALLATION**

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### **Deliverables**

1. Pre Installation conference with client and contractor
2. Verification that client has obtained required permits
3. Staking and layout according to plans and specifications including applicable layout notes
4. Installation inspection (according to inspection plan as appropriate)
  - a. Actual materials used (Part 512, Subpart D Quality Assurance Activities, 512.33)
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation
7. Certification that the installation process and materials meets design and permit requirements.

## **CHECK OUT**

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### **Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

**STATEMENT OF WORK**  
**Anaerobic Digester, Ambient Temperature (365)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Anaerobic Digester, Ambient Temperature, 365
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

**STATEMENT OF WORK**  
**Anaerobic Digester, Controlled Temperature (366)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

### **DESIGN**

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#### **Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
  - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Geology and Soil Mechanics (NEM Subpart 531a)
    - ii. Storage Volume
    - iii. Structural, Mechanical and Appurtenance design
    - iv. Environmental Considerations (e.g. air quality, bio-security)
    - v. Safety Considerations (NEM Part 503-Safety, Subpart A, 503.10 through 503.12)
2. Plans and Specifications including sketches and drawings sufficient to install the practice.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (a) (3))
6. Design modifications during installation as required.

### **INSTALLATION**

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#### **Deliverables**

1. Pre Installation conference with client and contractor
2. Verification that client has obtained required permits
3. Staking and layout according to plans and specifications including applicable layout notes
4. Installation inspection (according to inspection plan as appropriate)
  - a. Actual materials used (Part 512, Subpart D Quality Assurance Activities, 512.33)
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation
7. Certification that the installation process and materials meets design and permit requirements.

### **CHECK OUT**

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#### **Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities\
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

**STATEMENT OF WORK**  
**Anaerobic Digester, Controlled Temperature (366)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Anaerobic Digester, Controlled Temperature, 366
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

## **STATEMENT OF WORK**

### **Fish Passage (396)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

#### **DESIGN**

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##### **Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
  - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Hydrology/Hydraulics
    - ii. Structural
    - iii. Environmental Considerations (GM 190 ECS-Part 410.22)
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits...
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (a) (3)).
6. Design modifications during installation as required.

#### **INSTALLATION**

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##### **Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used (Part 512, Subchapter D Quality Assurance Activities, 512.33)
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

#### **CHECK OUT**

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##### **Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

**STATEMENT OF WORK**  
**Fish Passage (396)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Fish Passage, 396
- NRCS General Manual (GM)
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook
- NRCS National Biology Manual
- NRCS National Biology Handbook

**STATEMENT OF WORK**  
**FISH RACEWAY OR TANK (398)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

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**DESIGN**

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**Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
  - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Water quantity and quality
    - ii. Structural
    - iii. Environmental Considerations
    - iv. Safety Considerations (NEM Part 503-Safety, Subpart A, 503.10 through 503.12)
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits...
3. Operation and Maintenance Plan
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (a) (3)).
5. Design modifications during installation as required.

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**INSTALLATION**

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**Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used (Part 512, Subchapter D Quality Assurance Activities, 512.33)
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

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**CHECK OUT**

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**Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

**STATEMENT OF WORK  
FISH RACEWAY OR TANK (398)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Fish Raceway or Tank, 398
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

**STATEMENT OF WORK  
DAM (402)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

**DESIGN**

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**Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
  - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Geology and Soil Mechanics (NEM Subpart 531a)
    - ii. Hydrology/Hydraulics
    - iii. Structural including hazard class as appropriate
    - iv. Vegetation
    - v. Environmental Considerations
    - vi. Safety Considerations (NEM Part 503-Safety, Subpart A, 503.10 through 503.12)
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits...
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (a) (3)).
6. Design modifications during installation as required.

**INSTALLATION**

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**Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used (Part 512, Subchapter D Quality Assurance Activities, 512.33)
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

**CHECK OUT**

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**Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1))
3. Progress reporting

**STATEMENT OF WORK  
DAM (402)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard – Dam, 402
- NRCS National Engineering Manual (NEM).
- NRCS Technical Release 60, Earth Dams and Reservoirs
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

## STATEMENT OF WORK Hedgerow Planting (422)

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

### DESIGN

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#### Deliverables:

1. Design documents that demonstrate criteria in NRCS practice standard have been met and are compatible with planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Practice standard criteria-related computations and analyses to develop plans and specifications including but not limited to:
    - i. Determination of adapted species of woody plants or erect perennial bunch grasses and extent and position in row(s)
    - ii. Protective measures for planting to provide desired function
    - iii. Additional provisions, as required, for wildlife cover, living fences, boundary delineation, contour marking, screens, and landscape appearance
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Documentation of needed operation and maintenance.
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations.
5. Design modifications during installation as required.

### INSTALLATION

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#### Deliverables

1. Pre-application conference with client.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Application guidance as needed.
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the application process and materials meet design and permit requirements.

### CHECK OUT

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#### Deliverables

1. Records of application.
  - a. Extent of practice units applied
  - b. Actual plant materials used and applied
2. Certification that the application meets NRCS standards and specifications and is in compliance with permits.
3. Progress reporting.

### REFERENCES

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard – Hedgerow Planting, 422
- NRCS National Forestry Handbook (NFH), Part 636.4
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook
- NRCS National Biology Manual
- NRCS National Biology Handbook

**STATEMENT OF WORK****Irrigation Water Conveyance - Flexible Membrane Ditch and Canal Lining (428B)**

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

**DESIGN**

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**Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
  - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Capacity
    - ii. Channel velocity/Stability
    - iii. Membrane details (e.g. type, thickness, cover)
    - iv. Environmental Considerations
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Operation and Maintenance Plan
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (a) (3)).
5. Design modifications during installation as required.

**INSTALLATION**

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**Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used (Part 512, Subpart D Quality Assurance Activities, 512.33)
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

**CHECK OUT**

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**Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

**STATEMENT OF WORK**

**Irrigation Water Conveyance - Flexible Membrane Ditch and Canal Lining (428B)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Irrigation Water Conveyance Flexible Membrane Ditch and Canal Lining, 428b
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**LAND RECLAMATION, LANDSLIDE TREATMENT**

(No. and Ac.)

**CODE 453**

**DEFINITION**

Managing in-place natural materials, mine spoil (excavated over-burden), mine waste or overburden to reduce down-slope movement.

**PURPOSE**

- Repair unstable slopes caused by slope failure, and reduce the likelihood of enlargement or renewed movement of slope surfaces;
- Protect life and property;
- Prevent excessive erosion and sedimentation;
- Improve water quality and landscape resource quality; and
- Create a condition conducive to establishing surface protection and beneficial land use.

**CONDITIONS WHERE PRACTICE APPLIES**

To areas where in-place material, mine spoil, waste, or overburden, or rock cut road banks are unstable, moving, or judged to have potential of moving down slope in a manner that will cause damage to life, property, or the environment. It does not apply to constructed embankment surfaces such as road fills, dams, dikes, levees and terraces.

**CRITERIA**

**Investigations.** Investigations shall include and extend beyond the area of the landslide and shall be made to determine:

1. Surface profiles, cross sections, and topographic features
2. Geologic profiles and cross sections showing attitude and conditions of strata and details of the slip zone
3. Soil classification and properties, including gradation, density, strength, and chemical characteristics
4. Ground-water conditions
5. Depth extent, and volume of material involved
6. Estimated pre-slide profile and subsurface conditions

7. Conditions where slopes are stable in similar materials
8. Extrinsic factors (e.g. land use activities and/or precipitation events) that triggered or remobilized the failure.

Extreme caution must be exercised and careful planning is required before permitting any personnel, drilling equipment, or construction machinery, in the slide area. A slide is often active during wet periods and may be comparatively stable during dry periods.

**Slope stability.** Measures developed to prevent or stabilize slides shall be based on engineering analysis and judgment made by an engineer trained and experienced in soil mechanics and soil bioengineering.

Slope stability analysis shall account for all critical soil and loading conditions. The strength parameters of natural soil and rock or of waste materials shall be based on the appropriate conditions for each slide. Long-term strength parameters ( $c=0$  and internal friction based on residual shear) shall be used. The methods of slope stability analysis are to be appropriate for the loading conditions and for the location and shape of sliding or potential failure surfaces.

Appropriate safety factors shall be provided based on the degree of uncertainty in the soil strength values used, the soil and water conditions assumed, and the detail of the analysis used.

When there is a potential for loss of life or damage to farmsteads, residential areas, frequently traveled roads, occupied facilities, or important public utilities, the measures shall include removal of the material subject to sliding or any other control to ensure safety.

The requirements contained in the NRCS National Engineering Manual Part 531.26 (a) shall apply for the geologic investigations and seismic assessments. Criteria for minimum seismic coefficients and recurrence interval shall be as required in the state building code.

**Water control.** Sources of water that will enter the landslide area shall be controlled to the extent possible in accordance with the following:

- **Surface runoff water.** Runoff water that would enter the landslide area is to be intercepted and conveyed to a stable outlet.
- **Water from direct precipitation.** Infiltration shall be limited to the extent possible by providing positive surface drainage and sealing surface cracks within the area. Grading and shaping may be required to provide positive surface drainage. Terraces structures, and waterways are to be installed as needed to provide safe water disposal without erosion and with positive grade to reduce seepage. The surface of the treated area shall be protected from erosion as appropriate.
- **Ground water.** Design measures, including vegetative treatment where appropriate, shall be taken to intercept ground water that contributes to instability of the area. Drainage systems shall be designed in accordance with Part 633, Chapter 26 of the National Engineering Handbook, and the system shall be designed to remain operational in the event of limited movement of the area after construction.

**Earth material control.** The design shall take into consideration the following factors on impacting loading, strength or counter-buttressing as appropriate:

- earth material
- internal water
- rock material
- **Loading control.** Where appropriate, consider alternatives for loading control, including: removing excess material from the upper portions of the slide mass; removing the entire slide mass; dewatering at least the upper portion of the slide, and removing excess weight associated with development. Sites for safe disposal of excavated slide material should be identified as part of planning and design.
- **Slope reduction.** Critical slopes within the slide area shall be reduced by grading when practical.
- **Increasing internal strength.** The design shall analyze the impact of removing and recompacting of material at designed levels of

moisture and compactive effort. It shall also analyze the impact of biotechnical slope stabilization practices.

- **External restraints.** External restraints shall be used where slope movements must be limited due to high-valued improvements, and where manipulation of the earthen material may not achieve the desired results. External restraints shall be designed to withstand overturning, sliding at or below the base, and bearing failure of the foundation. All measures shall include provisions for proper drainage.

**Vegetative treatment.** Vegetation shall be planted using selected soil bioengineering or biotechnical slope stabilization techniques appropriate to the site. Deep rooted grasses and shrubs with proven performance in soil bioengineering applications shall be used. The transpiration potential and rooting depth of the vegetation applied shall be considered. Site conditions including soil pH, particle size, and nutrient content shall be analyzed, and this information used to select the appropriate vegetative treatment and plant materials for the site.

**Component practices.** All individual practices installed as a component of landslide treatment are to be designed and installed in accordance with applicable NRCS conservation practice standards and specifications. If NRCS standards are not available, the practice is to be designed and installed using current engineering technology.

**Environmental.** All disturbed areas are to be provided with adequate water disposal systems and established to vegetative cover, or otherwise protected, to control erosion and sediment as soon as practicable. Temporary protective measures will be necessary if a long delay is anticipated in establishing permanent cover. Human, animal and vehicular traffic is to be controlled to protect the area.

## CONSIDERATIONS

Consider offsite water quality effects such as acid mine drainage.

Consider designing drainage systems that remain operative after limited movement. Pipes should be used with caution because of the potential of breaking and/or misalignment with further movement. Flat or nearly flat gradients should be avoided for the same reasons.

Consider visual resources with other design features during planning, design, and installation.

All disturbed areas can be reshaped and regraded to blend in with the surrounding land features.

**Cultural Resources.** NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

**Endangered Species.** Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

## PLANS AND SPECIFICATIONS

Plans and specifications for slide treatment shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

## OPERATION AND MAINTENANCE

The maintenance plan is to include periodic inspections for additional movement, failure of water disposal systems, vegetation, and other problems. The water disposal system, subsurface drainage system, access roads, and vegetative cover are to be maintained to accomplish their intended purposes. Necessary maintenance and repair activities are to be initiated promptly.

## REFERENCES

Turner, A.K., and Schuster, R.L., *eds.*, 1996, Landslides: Investigation and Mitigation: Transportation Research Board Special Report 247, National Research Council, National Academy Press, Washington, D.C., 673 p.

USDA-NRCS, Oct. 1994, Soil Engineering Gradation Design of Sand and Gravel Filters: National Engineering Handbook Part 633, Chapter 26, 35 p. plus appendices, <http://www.info.usda.gov/CED/ftp/CED/neh633-ch26.pdf>.

USDA-SCS, June 1978, Groundwater: National Engineering Handbook Section 18, 6 chapters, <http://www.info.usda.gov/CED/ftp/CED/neh18.pdf>.

USDA-SCS, June 1971, Drainage of Agricultural Land: National Engineering Handbook Section 16, 9 chapters, <http://www.info.usda.gov/CED/ftp/CED/neh-16.htm>.

Rural Abandoned Mine Program (RAMP) Handbook. USDA-NRCS.

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

**453 – LAND RECLAMATION, LANDSLIDE TREATMENT**

**OPERATION AND MAINTENANCE**

Sponsor/Land user: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Location GPS Coordinates Map Datum: \_\_\_\_\_ E \_\_\_\_\_ N \_\_\_\_\_

Quad Sheet Name \_\_\_\_\_ SEC \_\_\_\_\_ T \_\_\_\_\_ R \_\_\_\_\_

A properly operated and maintained landslide treatment project is an asset to your farm. This project was designed and installed to protect the quality of surface water and groundwater resources, to eliminate a safety hazard for humans and livestock and to safeguard the public health.

The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

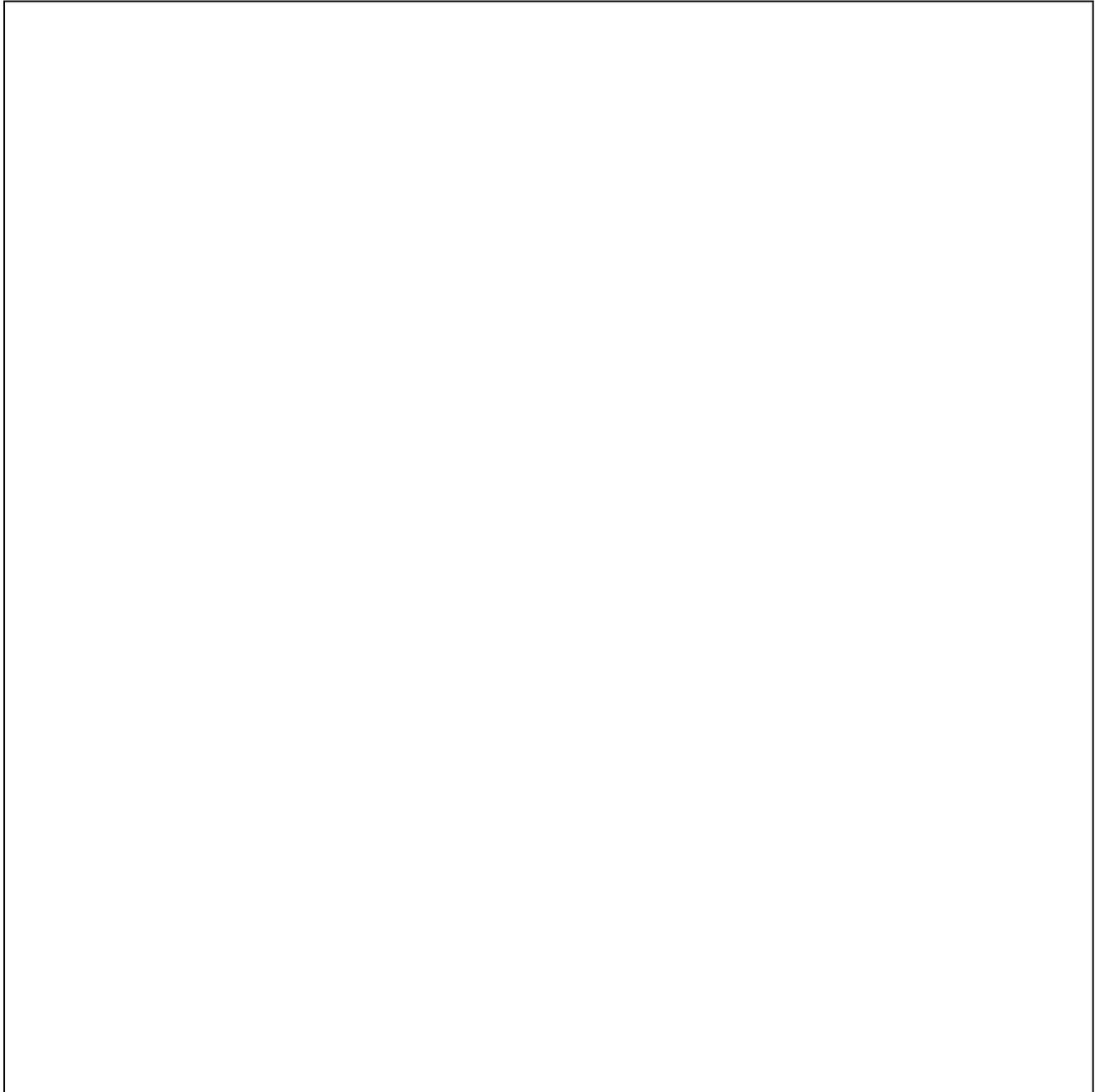
This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program.

**GENERAL RECOMMENDATIONS**

- Maintain appropriate warning signs.
- All fences, railings, and/or warning signs shall be maintained to prevent unauthorized human, vehicle or livestock entry. Repair and replace as necessary.
- Inspect haul roads and approaches to and from the project frequently to determine the need for stabilizing materials. Repair as needed.
- Inspect drainage structures and channels. Remove any obstructions to keep structures and channels clean and functional. Take corrective actions to address any erosion that occurs.
- Inspect project area after heavy rains. Promptly repair any damage. Fill rills and gullies that occur and re-vegetate.
- Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization, and application of herbicides when necessary. Periodic mowing may also be needed to control height.
- Maintain drainage systems in a functional condition. Repair or replace any clogged pipes. Take corrective actions to address any erosion that occurs.
- Immediately repair any vandalism, vehicular, or livestock damage.

- Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate corrective actions to alleviate further damage.
- Avoid excessive travel on any portion of the system that will harm or destroy the vegetative cover.

**SPECIFIC RECOMMENDATIONS FOR YOUR PROJECT**



**CONTACT YOUR LOCAL NATURAL RESOURCES CONSERVATION SERVICE OFFICE FOR ANY ADDITIONAL TECHNICAL ASSISTANCE YOU MIGHT NEED FOR IMPLEMENTATION OF THIS OPERATION AND MAINTENANCE PLAN FOR YOUR LANDSLIDE TREATMENT PROJECT.**

**STATEMENT OF WORK**  
**Land Reclamation, Landslide Treatment (453)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

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**DESIGN****Deliverables:**

1. Design documents that demonstrate criteria in NRCS practice standard have been met and are compatible with planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM part 503-Safety, Section 503.00 through 503.22)
  - d. Practice standard criteria-related computations and analyses to develop plans and specifications including but not limited to:
    - i. Investigations of static load, surface and slip zone slope, soil characteristics, and presence of water
    - ii. Determination of measures including water management consistent with on-site investigations and conditions that will prevent or stabilize landslides
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Operation and maintenance plan.
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations.
5. Design modifications during installation as required.

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**INSTALLATION****Deliverables**

1. Pre-installation conference with client.
2. Verification that client has obtained required permits.
3. Staking and layout of measures according to plans and specifications including applicable layout notes.
4. Installation guidance as needed.
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meet design and permit requirements.

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**CHECK OUT****Deliverables**

1. Records of installation.
  - a. Extent of practice units applied
  - b. Actual measures and materials used and applied
  - c. Drawings
  - d. Final quantities
2. Certification that the application meets NRCS standards and specifications and is in compliance with permits.
3. Progress reporting.

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**REFERENCES**

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard – Land Reclamation, Landslide Treatment, 453
- National Engineering Manual, Utility Safety Policy
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**MINE SHAFT AND ADIT CLOSING**

(No.)  
**CODE 457**

**DEFINITION**

Closure of underground mine openings by filling, plugging, capping, installing barriers, gating or fencing.

**PURPOSE**

- Reduce hazards to humans and/or animals
- Maintain or improve access and/or habitat for wildlife
- Protect cultural resources
- Reduce subsidence problems
- Reduce the emission of hazardous gases
- Reduce or prevent contamination of surface and ground water

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to the investigation, design and treatment of locations where shafts, subsidence pits or adits of underground mines are open or where prior closures can be modified to accomplish one or more of the above purposes.

This practice may be associated with surface treatment to reclaim the area surrounding the mine opening.

**CRITERIA**

**General Criteria Applicable to All Purposes**

The closure of mines shall be planned, designed and constructed to comply with all local, state, federal and tribal laws and regulations. Fences or gates shall be used where it is essential to occasionally enter or gain access to shafts or adits.

Fences, gates or other closure techniques that maintain or enhance bat and other wildlife habitat shall be considered where habitat exists. Where bats or other wildlife inhabit the mine, and wildlife friendly closures are not feasible, an exclusion plan for the bats or other wildlife shall be written and implemented.

Fencing, gates, caps, and walls shall be used only where periodic inspection and maintenance is ensured through a maintenance agreement with a responsible government entity, landowner, or organization.

Stockpiled soil or rock materials shall be protected from erosion until used.

**Safety.** Teams consisting of a minimum of two persons each are required to conduct searches for concealed shafts and adits, leaving their specific schedule with others. Safety barriers, ropes, safety belts, gas detectors, and other equipment must be used as necessary during site reconnaissance, surveying and foundation investigation activities.

If hazardous gas is present, a person with United States Mine Safety and Health Administration (MSHA) certification for underground work shall be on site to monitor safety during the site investigation and practice installation.

During construction, a collapse zone shall be established, clearly marked with fencing and warning notices, and no person shall enter this zone without wearing proper safety equipment.

Bumper blocks or other devices must be used to keep machinery and trucks from falling into shafts and subsidence pits. If possible, equipment blades and buckets shall be larger than the opening being filled.

If explosives or items that resemble explosives are found, do not handle them and report the findings to the local MSHA office.

At the completion of the closing, filled or plugged shaft or adit locations shall be marked in the field and an affidavit of mine closing shall be recorded with the local register of deeds to reduce the risk of future development over the shaft or adit.

**Report.** A site investigation report shall document the following information:

- Geology and groundwater conditions at the site
- Access conditions into mine
- Risks to life and property associated with the

mine

- Equipment and trash within mine
- Presence of hazardous gases
- Presence of acid mine drainage
- Mine history including mine plan if available
- Inventory of plant or animal species using the mine
- Potential for surficial changes due to water table variation

**Design References.** SCS Agricultural Engineering Note 1 contains guidance on investigation, safety, design and construction and is to be used as a procedural guide with this standard. Agricultural Engineering Note 1 was developed specifically for coal mines; not all the information contained in the Note applies to other types of mines.

Guidance for enclosures and gates for bat conservation purposes is found in Bats and Mines by Merlin D. Tuttle and Daniel A.R. Taylor.

#### **Additional Criteria for Fences and Gates**

Fences or gates shall be constructed to keep unauthorized persons out and shall be located where subsidence or caving will not break their integrity. Where applicable, fences and gates shall be designed to maintain or improve habitat and access for bats and other wildlife.

Fences or gates shall be made of steel, concrete, masonry, or "anti intruder" chain link and barbed wire fences or a combination of these materials.

#### **Additional Criteria for Designed Filling or Sealing**

Shafts and adits shall be cleaned of all trash, debris, metal, timber, wire and other materials that could hinder an effective designed filling or sealing.

The finished surface of the filled or plugged shaft or adit shall be graded to provide free drainage away from the opening and vegetation established in accordance with NRCS standards.

All materials removed shall be disposed of by burning or burying at approved sites or transported to approved landfills.

**a. Designed Filling.** Shafts or adits shall be filled to about 3 feet from the surface with a designed filter consisting of nonacid-forming, free-draining materials or polyurethane foam.

The remainder of the shaft or adit shall be filled with earth materials including a minimum of 3 feet of clay compacted in 9-inch lifts or other impervious materials that would retard the passage of water or gas. Shaft openings shall be overfilled 10 percent of the depth of the shaft, or 3 feet, whichever is less to allow for settlement.

Subsidence pits that are open, active, and/or passing a significant quantity of water require a designed filter of nonacid-forming, free-draining material. Sufficient soil covering shall be placed to sustain planned vegetation.

Subsidence pits that are closed, inactive and not passing a significant quantity of water shall require only backfilling with suitable soil material.

Sinkhole openings shall be overfilled 10 percent of the fill depth, or 3 feet, whichever is less to allow for settlement.

**b. Sealing with Plugs.** Shafts shall be closed with plugs only if another practical solution is not available. Installed below the ground surface, plugs are used where the shaft is to be filled to the surface but the shaft below is to remain open.

Plugs shall be constructed of reinforced concrete designed to support anticipated loads. The reinforced concrete shall be placed on firm bedrock. Plugs may be designed to be watertight and gastight or to allow drainage and venting of gases.

Shaft above the plug shall be filled to about 3 feet from the surface with a designed filter consisting of nonacid-forming, free-draining materials or polyurethane foam.

The remainder of the shaft above the plug shall be filled with earth materials including a minimum of 2 layers of clay, approximately 2 feet thick, or other impervious materials that would retard the passage of water or gas. Shaft openings shall be overfilled 10 percent of the depth of the shaft above the plug to allow for settlement.

The finished surface of the plugged shaft shall be graded to provide free drainage away from the opening and vegetation established in accordance with NRCS standards.

**c. Sealing with Caps and Walls.** Caps and walls shall be constructed of reinforced concrete or steel beams and grates or solid steel plates to completely close shaft or adit openings.

Caps and walls shall be designed with sufficient strength to support anticipated loads and shall be securely anchored.

The cap, wall, fittings, access holes and vent pipe shall be reasonably vandal proof. The surface of a cap over a shaft must be raised not less than 1 foot above the surrounding terrain to provide good visibility and positive drainage away from the cap installation.

**d. Sealing with Barriers.** Barriers shall be constructed to restrict humans and animals from entering adits, and may be used to prevent lateral spreading of backfill material and to support fill used to cover adit openings.

Barriers shall be constructed of stones, crushed rock, quarry-run rock, gravel or similar nonacid-forming, free-draining materials.

The minimum filled length of the barrier shall be three times the maximum adit height or width within the barrier section, whichever is greatest.

Concrete or masonry wall may be used to support the barrier. Barriers not supported by concrete or masonry walls shall have 3 horizontal to 1 vertical or flatter slopes.

Barriers at the ground surface shall be covered with soil materials to a minimum vertical thickness of 4 feet and vegetation shall be established in accordance with NRCS standards.

Where needed, a permanent drainage system using pipe or rock toes shall be installed through this covering. Traps to prevent air or gas passage shall be used where necessary.

**e. Sealing with Dams.** Dams are constructed to prevent water flow into or out of adits.

Dimensional requirements are those stated for barriers in the previous section.

The fill shall be essentially watertight and designed to support anticipated structural and hydraulic loads. Designed filters shall be incorporated to prevent piping of the fill material.

## CONSIDERATIONS

Consider the following for maintaining or enhancing bat and other wildlife habitat:

- Species using the mine.
- Seasons and purpose mine is used by bats or other wildlife.

- Effects on airflow and temperature of the mine caused by a closure. Small changes in environment can have significant negative or positive effects on suitability for bat use.

**Cultural Resources.** NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

**Endangered Species.** Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

## PLANS AND SPECIFICATIONS

Plans and specifications for closing shafts and adits shall be in keeping with this standard and shall

describe the requirements for applying the practice to the specific site to achieve its intended purpose or purposes.

#### **OPERATION AND MAINTENANCE**

Barriers, fences, gates and caps are to be maintained to accomplish their purpose.

A site-specific operation and maintenance plan shall be developed for all gated, fenced and capped closures. Regular inspections shall take place and prompt repair and follow-up shall be carried out. Additional maintenance activities shall be outlined in the maintenance plan.

#### **REFERENCES**

Tuttle, M.D., and Taylor, D.A.R., 1998, Bats and Mines: Bat Conservation International Resource Publication 3,  
<http://www.batcon.org/mines/handbook.html>  
(projects -> mines -> Bat and Mines Handbook).

USDA-SCS, January 1981, Treatment of Abandoned Mine Shafts and Adits, Based on Material from the National Coal Board, London England: Agricultural Engineering Note 1, 3 chapters plus appendix,  
<http://www.info.usda.gov/CED/ftp/CED/aen-1.pdf>.

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

**457 – MINE SHAFT AND ADIT CLOSING**

**OPERATION AND MAINTENANCE**

Sponsor/Land user: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

Location GPS Coordinates Map Datum: \_\_\_\_\_ E \_\_\_\_\_ N \_\_\_\_\_

Quad Sheet Name \_\_\_\_\_ SEC \_\_\_\_\_ T \_\_\_\_\_ R \_\_\_\_\_

A properly operated and maintained mine shaft and adit closing project is an asset to your farm. This project was designed and installed to fill or seal mine shafts and other openings to reduce subsidence problems, hazards to humans and animals, the emission of hazardous gases, and the pollution of surface and ground water, to close openings for human safety while maintaining access for wildlife species and/or to close openings for the protection of cultural resources.

The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program.

**GENERAL RECOMMENDATIONS**

- Maintain appropriate warning signs.
- All fences, railings, barriers fences and/or warning signs shall be maintained to prevent unauthorized human, vehicle or livestock entry. Repair and replace as necessary.
- Inspect project site yearly and fill areas where settlement is adversely affecting drainage and land use. Re-vegetate as necessary.
- Add soil amendments to soils that cannot support adequate vegetation or replace them with suitable soil material.
- Inspect haul roads and approaches to and from the project frequently to determine the need for stabilizing materials. Repair as needed.
- Inspect project area after heavy rains. Promptly repair any damage. Fill rills and gullies that occur and re-vegetate.

- Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization, and application of herbicides when necessary. Periodic mowing may also be needed to control height.
- Repair spalls, cracks and weathered areas in concrete surfaces.
- Repair or replace rusted or damaged metal and apply paint as a protective coating.
- Immediately repair any vandalism, vehicular, or livestock damage.
- Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate corrective actions to alleviate further damage.
- Avoid excessive travel on any portion of the system that will harm or destroy the vegetative cover.

**SPECIFIC RECOMMENDATIONS FOR YOUR PROJECT**

**CONTACT YOUR LOCAL NATURAL RESOURCES CONSERVATION SERVICE OFFICE FOR ANY ADDITIONAL TECHNICAL ASSISTANCE YOU MIGHT NEED FOR IMPLEMENTATION OF THIS OPERATION AND MAINTENANCE PLAN FOR YOUR MINE SHAFT AND ADIT CLOSING PROJECT.**

**STATEMENT OF WORK**  
**Mine Shaft and Adit Closing (457)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

## **DESIGN**

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### **Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan.
  - b. List of required permits to be obtained by the client.
  - c. Impacts on adjacent properties and structures.
  - d. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06).
  - e. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Structural
    - ii. Safety
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03(b)(2)).
6. Design modifications during installation as required.

## **INSTALLATION**

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### **Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used.
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

## **CHECK OUT**

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### **Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03(c)(1)).
3. Progress reporting.

**STATEMENT OF WORK**  
**Mine Shaft and Adit Closing (457)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Mine Shaft and Adit Closing, 457.
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

**STATEMENT OF WORK**  
**DRAINAGE WATER MANAGEMENT (554)**

**These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.**

## **DESIGN**

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### **Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan
  - b. List of required permits to be obtained by the client
  - c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06)
  - d. List of facilitating/component practices
  - e. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Geology and Soil Mechanics (NEM Subpart 531a)
    - ii. Hydrology/Hydraulics
    - iii. Structural
    - iv. Vegetation
    - v. Environmental Considerations
    - vi. Safety Considerations (NEM Part 503-Safety, Subpart A, 503.10 through 503.12)
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits...
3. Operation and Maintenance Plan (National Operation and Maintenance Manual 500.70 and 500.40 through 500.42)
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03 (a) (3)).
5. Design modifications during installation as required.

## **INSTALLATION**

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### **Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used (Part 512, Subchapter D Quality Assurance Activities, 512.33)
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

## **CHECK OUT**

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### **Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03 (c) (1)).
3. Progress reporting.

**STATEMENT OF WORK  
DRAINAGE WATER MANAGEMENT (554)**

**REFERENCES**

---

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Drainage Water Management, 554
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**HEAVY USE AREA PROTECTION**

(Acre)  
**CODE 561**

**DEFINITION**

The stabilization of areas frequently and intensively used by people, animals or vehicles by establishing vegetative cover, by surfacing with suitable materials, and/or by installing needed structures.

**PURPOSES**

This practice may be used as a part of a conservation management system to support one or more of the following purposes.

- Reduce soil erosion
- Improve water quantity and quality
- Improve air quality
- Improve aesthetics
- Improve livestock health

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to urban, agricultural, recreational, or other frequently and intensively used areas requiring treatment to address one or more resource concerns.

**CRITERIA**

*General Criteria Applicable to All Purposes*

All planned work shall comply with federal, state, and local laws and regulations.

Measures shall be taken to limit the generation of particulate matter.

Safety of the users shall be incorporated into the design of the heavy use area protection.

**Design Load** - The design load will be based on the type of traffic, (vehicular, animal, or human) anticipated on the heavy use area.

The minimum design load for areas that support vehicular traffic will be a wheel load of 4000 lbs.

**Foundation** - All site foundations shall be evaluated for soil moisture, permeability, texture and bearing strength in combination with the design load and anticipated frequency of use.

A base course of gravel, crushed stone, other suitable material and/or geotextile shall be provided on all sites with a need for increased load bearing strength,

drainage, separation of material and soil reinforcement. Natural Resources Conservation Service (NRCS), National Engineering Handbook (NEH), Parts 642 and 643 (formerly, NEH, Section 20) and AASHTO M-288 (latest edition) provide guidance in quality specification and geotextile selection.

An impervious barrier shall be provided on sites with a porous foundation (high permeability rate), where there is a need to protect ground water from contamination.

Foundation preparation shall consist of removal and disposal of soil and other material that are not adequate to support the design loads.

**Surface treatment** - The surface treatment shall meet the following criteria:

**Bituminous Pavement** - The thickness of the pavement course, the kind and size of aggregate, the type of proportioning of bituminous materials, and the mixing and placing of these materials shall be in accordance with Department of Transportation criteria for the expected loading.

**Concrete** - The quality and thickness of concrete and the spacing and size of reinforcing steel shall be appropriate for the expected loading.

**Other Cementitious Materials** - Soil cement, roller compacted concrete, and coal combustion by-products (flue gas desulfurization sludge and fly ash) may be used as surface material if designed and installed to withstand the anticipated loads and surface abrasion.

**Aggregate** - A fine or coarse aggregate surface shall be a minimum 2-inches thick.

**Other** - Surfacing materials, such as cinders, bark mulch, brick chips, shredded rubber and/or sawdust, shall have a minimum layer thickness of 2 inches.

**Structures** - All structures shall be designed according to appropriate NRCS standards and specifications or Engineering Handbook recommendations.

**Roof Rainfall Diversion Structures** - Roof rainfall diversion structures shall be designed, by a registered Civil Engineer, Structural Engineer or Architect, licensed to practice in California, to meet all state, county and local building codes. The roof rainfall diversion structure shall be suitable for the site and designed to meet all site-specific requirements. NRCS shall provide the designer with a detailed site map

(showing all planned practices), a detailed topographical map and NRCS Soil Survey information.

The engineer or architect shall provide construction plans, specifications and Operation and Maintenance guidance for the roof rainfall diversion structure.

The design shall consider all anticipated loads, including live loads, dead loads, wind, snow, ice and seismic loads, that will influence the performance of the structure, material properties and construction quality. Design assumptions and construction requirements shall be indicated on standard plan.

Fabricated structures shall be designed according to the criteria in the following references as appropriate:

- Steel: “Manual of Steel Construction”, American Institute of Steel Construction.
- Timber: “National Design Specifications for Wood Construction”, American Forest and Paper Association.
- Concrete: “Building Code Requirements for Reinforced Concrete, ACI 318”, American Concrete Institute.
- Masonry: “Building Code Requirements for Masonry Structures, ACI 530”, American Concrete Institute
- ASAE EP288.5, Agricultural Building Snow and Wind Loads
- ASAE EP 378.3, Floor and Suspended Loads on Agricultural Structures Due to Use

The plans, including the foundation work, shall be signed and sealed by a registered Civil Engineer, Structural Engineer or Architect.

**Sprays, artificial mulches and mulches** - Sprays of asphalt, oil, plastic, manufactured mulches, and similar materials shall be installed according to the manufacturer's recommendations. Application of other mulches will follow Mulching – Standard 484.

**Drainage and erosion control** - Provision shall be made for surface and subsurface drainage, as needed, and for disposal of runoff without causing erosion or water quality impairment. Provision shall be made to exclude unpolluted run-on water from the treatment area. All treatment areas shall be shaped to prevent ponding of water.

#### **Vegetative Measures**

Plant Species: Preference should be given to native plants in most settings. However, in heavily used areas or where special characteristics are desirable non-native plants may better adapt to local situations. Plant

hardiness and soil suitability are plant selection factors. Species recommendations for local use are contained in the Vegetative Guide of the Field Office Technical Guide.

Plant Spacing: Plants shall be spaced according to the planting plan or specifications. Spacing is determined by many factors including plant height, spread, habit, effect desired, etc.

Planting Methods, Time of Planting, etc., will follow Standard and Specification for Tree/Shrub Establishment – Standard 612 or Critical Area Treatment – Standard 342.

If vegetation is not appropriate, other measures shall be used to accomplish the intended purpose.

#### **Additional Criteria for Areas Utilized by Livestock**

The treated area shall extend an appropriate distance from facilities such as portable hay rings, water troughs, feeding troughs, mineral boxes and other facilities where livestock concentrations cause resource concerns.

NRCS conservation practice standards Critical Area Planting, Code 342; Fencing, Code 382; Prescribed Grazing, Code 528A; Filter Strip, Code 393; Roof Runoff Structure, Code 558 or Use Exclusion, Code 472 shall be used as companion practices, when needed, to meet the intended purpose of the heavy use area protection.

Provisions shall be made to collect, store, utilize and/or treat manure accumulations and contaminated runoff in accordance with NRCS's National Engineering Handbook (NEH) Part 651, Agricultural Waste Management Field Handbook.

#### **Additional Criteria for Areas Utilized for Recreation**

The treated area shall be conducive to the overall recreation area and aesthetically blend with the general landscape and surroundings.

Plants, landscaping timbers, traffic control measures, wooden walkways, etc. shall be evaluated for effectiveness, aesthetics and accessibility as covered by the Americans with Disabilities Act.

#### **CONSIDERATIONS**

When stabilizing heavily used areas consider adjoining land uses and the proximity to residences, utilities, cultural resource areas, wetlands or other environmentally sensitive areas, and areas of special scenic value.

For areas with aggregate surfaces that will be frequently scraped, consideration should be given to

the use of concrete or cementitious materials to lessen the recurring cost of aggregate replacement.

The size of heavy use areas utilized by livestock is dependent on the landowner's operation including type and number of animal, confinement periods, and/or the intended use. The size of treatment areas can range from 30 square feet per animal in partial-confinement to 400 square feet per animal in total confinement to 4000 or more square feet for animal exercise areas. Heavy use protection areas should be kept as small as practicable.

For heavy use areas conducive to protection by vegetation, consideration must be given to the effect(s) of treading and/or miring. The vegetative species selected should tolerate and persist under heavy use conditions. If practicable, consider increasing the size of the area and/or establishing a rest/non-use period to allow plant recovery and increase vigor.

When surface treatments such as bark mulch, wood-fiber or other non-durable materials are used for short-term livestock containment areas, consideration should be given to vegetation of the affected area with a cover crop.

If the purpose of the heavy use area protection is improvement of water quality, the heavy use area should be (re) located as far away from the water body or watercourse as possible. Any work in and/or discharges near streams, wetlands or water bodies may require a permit from the US Army Corps of Engineers, state water quality (permitting) authority, or local authority.

Consider using additional air quality conservation practices such as Windbreak/Shelterbelt Establishment (code 380) or Herbaceous Wind Barriers (code 603) to impede transport of particulate matter between the source (i.e., heavy use area) and nearby sensitive areas.

The transport of sediments, nutrients, bacteria, organic matter from animal manures, oils and chemicals associated with vehicular traffic, and soluble and sediment-attached substances carried by runoff should be considered in selection of companion conservation practices. Consider practices to collect and store rainfall away from manured areas.

### **Cultural Resources Considerations**

Determine if installation of this practice with any others proposed will have any effect on any cultural resources. NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. GM 420, Part 401, the California Environmental Handbook and the training for the California Environmental Assessment Worksheet

specify how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information, about cultural resources. The Environmental Handbook is online at [www.ca.nrcs.usda.gov/rts/rts.html](http://www.ca.nrcs.usda.gov/rts/rts.html).

### **Endangered Species Considerations**

Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

### **Water Quantity**

Paved areas installed for livestock use will increase organic, bacteria, and nutrient loading to surface waters. Changes in ground water quality will be minor. Nitrate nitrogen applied as fertilizer in excess of vegetation needs may move with infiltrating waters. The extent of the problem, if any, may depend on the actual amount of water percolating below the root zone.

More impervious protection may decrease or eliminate infiltration; the use of vegetation may increase infiltration. Where vegetation is used, transpiration may increase. Reduced infiltration may decrease potential for deep percolation and ground water recharge.

Heavy use area protection effects on the water budget, especially on volumes and rates of runoff, infiltration, and transpiration due to the installation of less pervious surfaces should be considered in the selection of surfacing materials.

### **Water Quality**

Protection with materials such as asphalt and concrete may decrease the opportunity for infiltration and may result in increased runoff of essentially all of the precipitation. Protection by use of porous paving or cellular blocks will reduce these detrimental effects. Protection with vegetation may reduce runoff by increasing the opportunity time for infiltration.

Protection may result in a general improvement of surface water quality through the reduction of erosion and the resulting sedimentation. Some increase in erosion may occur during and immediately after construction until the disturbed areas are fully stabilized.

Some increase in chemicals in surface water may occur due to the introduction of fertilizers for vegetated areas and oils and chemicals associated with paved areas. Fertilizers and pesticides used during operation and maintenance may be a source of water pollution.

### **PLANS AND SPECIFICATIONS**

Plans and specifications for heavy use area protection shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Plans and specifications shall include construction plans, drawings, job sheets or other similar documents. These documents shall specify the requirements for installing the practice, including the kind, amount and quality of materials to be used.

### **OPERATION AND MAINTENANCE**

An Operation and Maintenance (O&M) plan shall be prepared for and reviewed with the landowner or others responsible for operating this practice.

The plan shall provide specific instructions for operating and maintaining the system to insure that it functions properly. It should also provide for periodic inspections and prompt repair or replacement of damage components.

The plan shall specify that the treated areas and associated practices are inspected annually and after significant storm events to identify repair and maintenance needs.

The O&M plan shall detail the level of repairs needed to maintain the effectiveness and useful life of the practice.

For livestock operations, the O&M plan for heavy use areas may be included as a part of the overall waste management plan. Periodic removal and management of manure accumulations will be addressed in the O&M plan.

O&M guidance for roof runoff diversion structures will be provided by the engineer who designs this aspect of the project.

## STATEMENT OF WORK

### Stream Crossing (578)

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

#### DESIGN

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##### Deliverables:

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Type of stream crossing and practice purpose(s) as identified in the conservation plan.
  - b. List of required permits to be obtained by the client.
  - c. Impacts on adjacent properties and structures.
  - d. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06).
  - e. List of facilitating practices
  - f. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Geology/Soil Mechanics
    - ii. Hydrology/Hydraulics
    - iii. Structural
    - iv. Vegetation/Soil Bioengineering
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03(b) (2)).
6. Design modifications during installation as required.

#### INSTALLATION

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##### Deliverables

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used.
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

#### CHECK OUT

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##### Deliverables

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03(c) (1)).
3. Progress reporting.

**STATEMENT OF WORK  
Stream Crossing (578)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Stream Crossing, 578.
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**STREAMBANK AND SHORELINE PROTECTION**  
(Ft.)  
**CODE 580**

**DEFINITION**

Treatment(s) used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes, reservoirs, or estuaries.

**PURPOSE**

- To prevent the loss of land or damage to land uses, or facilities adjacent to the banks of streams or constructed channels, shoreline of lakes, reservoirs, or estuaries including the protection of known historical, archeological, and traditional cultural properties.
- To maintain the flow capacity of streams or channels.
- Reduce the offsite or downstream effects of sediment resulting from bank erosion.
- To improve or enhance the stream corridor for fish and wildlife habitat, aesthetics, recreation.

**CONDITIONS WHERE PRACTICE APPLIES**

This practice applies to streambanks of natural or constructed channels and shorelines of lakes, reservoirs, or estuaries where they are susceptible to erosion. It does not apply to erosion problems on main ocean fronts, beaches or similar areas of complexity.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Treatments shall be in accordance with all applicable local, state and federal laws and regulations.

Treatments applied shall seek to avoid adverse effects to endangered, threatened, and candidate species and their habitats, whenever possible.

Treatments applied shall seek to avoid adverse effects to archaeological, historic, structural, and traditional cultural properties, whenever possible.

An assessment of unstable streambank or shoreline sites shall be conducted in sufficient detail to identify the causes contributing to the instability (e.g. livestock access, watershed alterations resulting in significant modifications of discharge or sediment production, in channel modifications such as gravel mining, head cutting, water level fluctuations, boat-generated waves, etc.).

Proposed protective treatments to be applied shall be compatible with improvements being planned or installed by others.

Protective treatments shall be compatible with the bank or shoreline materials, water chemistry, channel or lake hydraulics, and slope characteristics above and below the water line.

End sections of treatment areas shall be adequately anchored to existing treatments, terminate in stable areas, or be otherwise stabilized to prevent flanking of the treatment.

Protective treatments shall be installed that result in stable slopes. Design limitations of the bank or shoreline materials and type of measure installed shall determine steepest permissible slopes.

Designs will provide for protection of installed treatments from overbank flows resulting from upslope runoff and flood return flows.

Internal drainage for bank seepage shall be provided when needed. Geotextiles or properly designed filter bedding shall be incorporated with structural measures where there is the potential for migration of material from behind the measure.

Treatments shall be designed to account for any anticipated ice action, wave action, and fluctuating water levels.

All disturbed areas around protective treatments shall be protected from erosion. Disturbed areas that are not to be cultivated shall be protected as soon as practical after construction.

Vegetation shall be selected that is best suited for the site conditions and achieves the intended purpose(s).

The establishment of vegetation on channel banks and associated areas shall be in accordance with conservation practice standard Channel Bank Vegetation, Code 322.

#### **Additional Criteria for Streambanks**

Stream segments to be protected shall be classified according to a system deemed appropriate by the state. Segments that are incised or that contain the 5-year return period (20 percent probability) or greater flows shall be evaluated for further degradation or aggradation.

A site assessment shall be performed to determine if the causes of instability are local (e.g. poor soils, high water table in banks, alignment, obstructions deflecting flows into bank, etc.) or systemic in nature (e.g. aggradation due to increased sediment from the watershed, increased runoff due to urban development in the watershed, degradation due to channel modifications, etc.). The assessment need only be of the extent and detail necessary to provide a basis for design of the bank treatments and reasonable confidence that the treatments will perform adequately for the design life of the measure.

Changes in channel alignment shall not be made without an assessment of both upstream and downstream fluvial geomorphology that evaluates the affects of the proposed alignment. The current and future discharge-sediment regime shall be based on an assessment of the watershed above the proposed channel alignment.

Bank protection treatment shall not be installed in channel systems undergoing rapid and extensive changes in bottom grade and/or alignment unless the treatments are designed to control or accommodate the changes. Bank treatment shall be constructed to a depth at or below the anticipated lowest depth of streambed scour.

If the failure mechanism is a result of the degradation or removal of riparian vegetation, stream corridor restoration shall be implemented, where feasible, (see Additional Criteria for Stream Corridor Improvement) as well as treating the banks.

Toe erosion shall be stabilized by treatments that redirect the stream flow away from the toe or by structural treatments that armor the toe. Additional design guidance is found in the NEH Part 650, Chapter 16, Streambank and Shoreline Protection.

Where toe protection alone is inadequate to stabilize the bank, the upper bank shall be shaped to a stable slope and vegetated, or shall be stabilized with structural or soil-bioengineering treatments.

Channel clearing to remove stumps, fallen trees, debris, and sediment bars shall only be performed when they are causing or could cause unacceptable bank erosion, flow restriction, or damage to structures. Habitat forming elements that provide cover, food, pools, and water turbulence shall be retained or replaced to the extent possible.

Treatments shall be functional and stable for the design flow and sustainable for higher flow conditions.

Treatments shall not induce an increase in natural erosion.

Treatments shall not limit stream flow access to the floodplain.

Where flooding is a concern, the effects of protective treatments shall not increase flow levels above those that existed prior to installation.

#### **Additional Criteria for Shorelines**

All revetments, bulkheads or groins are to be no higher than 3 feet (1 meter) above mean high tide, or mean high water in non-tidal areas

Structural shoreline protective treatments shall be keyed to a depth to prevent scour during low water.

For the design of structural treatments, the site characteristics below the waterline shall be evaluated for a minimum of 50 feet (15 meters) horizontal distance from the shoreline measured at the design water surface.

The height of the protection shall be based on the design water surface plus the computed wave height and freeboard. The design water surface in tidal areas shall be mean high tide.

When vegetation is selected as the protective treatment, a temporary breakwater shall be used during establishment when wave run up would damage the vegetation.

#### **Additional Criteria for Stream Corridor Improvement**

Stream corridor vegetative components shall be established as necessary for ecosystem functioning and stability. The appropriate composition of vegetative components is a key element in preventing excess long-term channel migration in re-established

stream corridors. The establishment of vegetation on channel banks and associated areas shall be in accordance with conservation practice standard Channel Bank Vegetation, Code 322.

Treatments shall be designed to achieve habitat and population objectives for fish and wildlife species or communities of concern as determined by a site-specific assessment or management plan. Objectives shall be based on the survival and reproductive needs of populations and communities, which include habitat diversity, habitat linkages, daily and seasonal habitat ranges, limiting factors and native plant communities. The type, amount, and distribution of vegetation shall be based on the requirements of the fish and wildlife species or communities of concern to the extent possible.

Treatments shall be designed to meet aesthetic objectives as determined by a site-specific assessment or management plan. Aesthetic objectives shall be based on human needs, including visual quality, noise control, and microclimate control. Construction materials, grading practices, and other site development elements shall be selected and designed to be compatible with adjacent land uses.

Treatments shall be designed to achieve recreation objectives as determined by a site-specific assessment or management plan. Safety requirements shall be based on type of human use and recreation objectives.

## **CONSIDERATIONS**

When designing protective treatments, consider the changes that may occur in the watershed hydrology and sedimentation over the design life of the treatments.

Consider utilizing debris removed from the channel or streambank into the treatment design when it is compatible with the intended purpose.

Use construction materials, grading practices, vegetation, and other site development elements that minimize visual impacts and maintain or complement existing landscape uses such as pedestrian paths, climate controls, buffers, etc. Avoid excessive disturbance and compaction of the site during installation.

Utilize vegetative species that are native and/or compatible with local ecosystems. Avoid introduced or exotic species that could become nuisances. Consider species that have multiple values such as

those suited for biomass, nuts, fruit, browse, nesting, aesthetics and tolerance to locally used herbicides. Avoid species that may be alternate hosts to disease or undesirable pests. Species diversity should be considered to avoid loss of function due to species-specific pests. Species on noxious plant lists should not be used.

Treatments that promote beneficial sediment deposition and the filtering of sediment, sediment-attached, and dissolved substances should be considered.

Consider maintaining or improving the habitat value for fish and wildlife by including treatments that provide aquatic habitat in the treatment design and that may lower or moderate water temperature and improve water quality.

Consider the need to stabilize side channel inlets and outlets and outlets of tributary streams from erosion.

Consider aquatic habitat when selecting the type of toe stabilization.

Consider maximizing adjacent wetland functions and values with the project design and minimize adverse effects to existing wetland functions and values.

Livestock exclusion shall be considered during establishment of vegetative treatments and appropriate grazing practices applied after establishment to maintain plant community integrity. Wildlife may also need to be controlled during establishment of vegetative treatments. Temporary and local population control methods should be used with caution and within state and local regulations.

When appropriate, establish a buffer strip and/or diversion at the top of the bank or shoreline protection zone to help maintain and protect installed treatments, improve their function, filter out sediments, nutrients, and pollutants from runoff, and provide additional wildlife habitat.

Consider conservation and stabilization of archeological, historic, structural and traditional cultural properties when applicable.

Consider safety hazards to boaters, swimmers, or people using the shoreline or streambank when designing treatments.

Protective treatments should be self-sustaining or require minimum maintenance.

## **Cultural Resources Considerations**

NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

### **Endangered Species Considerations**

Determine if installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates that the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Some species are year-round residents in some streams, such as, freshwater shrimp. Other species, such as steelhead and salmon, utilize streams during various seasons. Be aware that critical periods, such as spawning, eggs in gravels and rearing of young may preclude activities in the stream that may directly affect the stream habitat during those periods. For example, there should be no disturbance of stream gravel beds that may have eggs in them. That could include any equipment in the stream or

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July 2005

even walking in the stream or work upstream that may result in sediment depositing in the gravel beds. Document any special considerations for endangered species in the Practice Requirements Worksheet.

### **PLANS AND SPECIFICATIONS**

Plans and specifications for streambank and shoreline protection shall be prepared for specific field sites and based on this standard and shall describe the requirements for applying the practice to achieve its intended purpose. Plans shall include treatments to minimize erosion and sediment production during construction and provisions necessary to comply with conditions of any environmental agreements, biological opinions or other terms of applicable permits.

### **OPERATION AND MAINTENANCE**

An operation and maintenance plan shall be prepared for use by the owner or others responsible for operating and maintaining the system. The plan shall provide specific instructions for operating and maintaining the system to insure that it functions properly. It shall also provide for periodic inspections and prompt repair or replacement of damaged components or erosion.

### **REFERENCES**

- NEH Part 650, Chapter 16, Streambank and Shoreline Protection,  
<http://www.info.usda.gov/CED/ftp/CED/EFH-Ch16.pdf>
- NRCS Conservation Practice Standard, Channel Bank Vegetation, Code 322
- NRCS Technical Note-Engineering-CA-14, September 2003

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE SPECIFICATION

## 580 - STREAMBANK AND SHORELINE PROTECTION

### I. SCOPE

The work shall consist of furnishing of materials and constructing streambank protection measures to the lines, grades, elevations and dimensions as shown on the drawings or as staked in the field.

### II. SITE PREPARATION

Trees and brush on the banks as marked in the field or shown on the drawings shall be removed and disposed of in designated areas. Removal of any trees and brush shall be done in such a manner as to avoid damage to other trees and property. Disposal of trees, brush, and other materials shall be performed to have the least detrimental effect on the environment.

Fallen trees, stumps, debris, minor ledge outcroppings and sand and gravel bars as shown on the drawings shall be removed and disposed of in designated areas.

Clearing and disposal methods shall be in accordance with state and county laws with due regard to the safety of persons and property.

### III. BANK PROTECTION MEASURES

The type and extent of bank protection measures shall conform to the structural requirements of the specifications listed on the Practice Requirements sheet.

### IV. FENCING

Fencing shall be installed at locations and of the materials shown on the drawings.

### V. VEGETATIVE COVER

Unless otherwise specified, a protective cover of vegetation shall be established on the disturbed area. The planting of vegetative materials shall conform to the requirements of Practice Specification 342, Critical Area Planting.

### VI. SPECIAL MEASURES

Measures and construction methods shall be incorporated as needed and practical that enhance fish and wildlife values. Special attention shall be given to

protecting visual resources and maintaining key shade, food and den trees.

### VII. CONSTRUCTION OPERATIONS

Construction operations shall be done in such a manner that erosion and air and water pollution are minimized and held within legal limits. The owner, operator, Contractor or other persons will conduct all work and operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

The completed job shall be workmanlike and present a good appearance.

### OPERATION AND MAINTENANCE ITEMS

A properly operated and maintained streambank or shoreline protection is an asset to your farm. The streambank or shoreline protection was designed and installed to stabilize an eroding area. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic maintenance and may also require operational items to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program.

Check all rock riprap sections for accelerated weathering and displacement. Replace to original grades if necessary.

Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control height.

All settlement or cracks in the soil should be investigated to determine the cause and immediately repaired.

If fences are installed, they shall be maintained to prevent unauthorized or livestock entry.

Remove debris that may accumulate at this section, and immediately upstream or downstream from this installation.

Control livestock access on unfenced areas.

Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.

Immediately repair any vandalism, vehicular, or livestock damage.

Other items specific to your project are listed on the "Practice Requirement" sheet.

U.S DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE  
CALIFORNIA

**PRACTICE REQUIREMENTS  
FOR  
580 - STREAMBANK AND SHORELINE PROTECTION**

For: Business Name \_\_\_\_\_  
Job Location \_\_\_\_\_  
County \_\_\_\_\_ RCD \_\_\_\_\_ Farm/Tract No. \_\_\_\_\_  
Referral No. \_\_\_\_\_ Prepared By \_\_\_\_\_ Date \_\_\_\_\_

**IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.**

Installation shall be in accordance with the following drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF THE NRCS TECHNICIAN.

1. Drawings, No. \_\_\_\_\_
2. Practice Specifications \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
3. Type of bank protection: \_\_\_\_\_
4. Special Requirements: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
5. Special Maintenance Requirements: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**PRACTICE APPROVAL:**

Job Classification: (Ref: Section 501 NEM)

Show the limiting elements for this job. This job is classified as, Class \_\_\_\_\_

Limiting elements:	Units
<u>Design Capacity</u> _____	_____ cfs
<u>Drainage Area</u> _____	_____ sq mi
<u>Channel Depth</u> _____	_____ ft
_____	_____

Design Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

**LANDOWNER'S/OPERATOR'S ACKNOWLEDGEMENT:**

The landowner/operator acknowledges that:

- a. He/she has received a copy of the drawings and specification, and that he/she has an understanding of the contents, and the requirements.
- b. He/she has obtained all the necessary permits.
- c. No changes will be made in the installation of the job without prior concurrence of the NRCS technician.
- d. Maintenance of the installed work is necessary for proper performance during the project life.

Accepted by: \_\_\_\_\_ Date: \_\_\_\_\_

**PRACTICE COMPLETION:**

I have made an on site inspection of the site (or I am accepting owner/contractor documentation), and have determined that the job as installed does conform to the drawings and practice specifications.

Completion Certification by:

/s/ \_\_\_\_\_ Date \_\_\_\_\_

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

**580 – STREAMBANK AND SHORELINE PROTECTION**

**OPERATION AND MAINTENANCE**

Sponsor/Land user: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Location GPS Coordinates Map Datum: \_\_\_\_\_ E \_\_\_\_\_ N \_\_\_\_\_

Quad Sheet Name \_\_\_\_\_ SEC \_\_\_\_\_ T \_\_\_\_\_ R \_\_\_\_\_

A properly maintained streambank and shoreline is an asset to your property. This practice was designed and installed to provide streambank and shoreline erosion protection. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

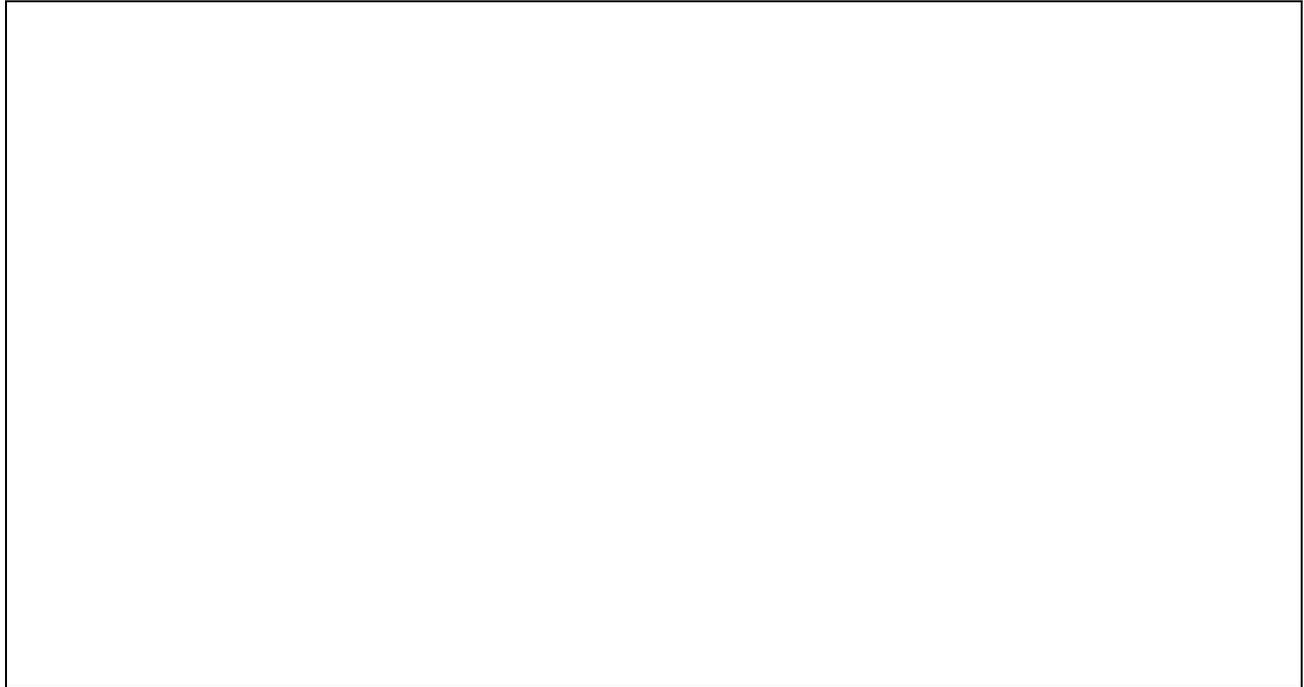
This practice will require you to perform periodic operation to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program. Additional permits may be required to perform this work.

**GENERAL RECOMMENDATIONS**

- Inspect the integrity of fences, access roads, water access, crossings and other livestock control measures. Replace or repair as necessary.
- Soil bioengineering measures should be assessed during drought and immediately after high flows. Inspection of bank and channel measures should be conducted during low-water conditions to allow viewing of the measure as well as changes to the stream bed that may affect future integrity of the system. Early failure is an inherent risk of soil bioengineered structures systems that are not fully effective until the plants are well rooted and the stems reach a particular size and density. Repair and replant as required.
- Periodically remove bars that can cause reduced capacity and damage to stream channel stability and bank protection taking into consideration fish habitat, fill and removal permit regulation and period of the year work can be performed in the water portion of the stream.
- Routine maintenance of vegetation includes removal of hazardous trees and branches that threaten safety, buildings, fences, as well as vegetation along road shoulders, trails and similar features. Maintain vigorous growth of desirable vegetative coverings. This includes reseeding, fertilization, and controlled application of herbicides when necessary. Periodic mowing may also be needed to control height.
- Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate corrective actions to alleviate further damage.
- Immediately repair any vandalism, vehicular, or livestock damage.

- Remove excess debris that may accumulate on or in the immediate area of any structures.
- All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.
- Check all timber or lumber sections for decay and other damage, especially sections in contact with earth or other materials. Repair damaged sections.
- Repair spalls, cracks and weathered areas in concrete surfaces.
- Repair or replace rusted or damaged metal and apply paint as a protective coating.
- Control livestock access to the structure. Livestock may be injured. Repair damaged vegetation and earthfills or accelerated soil erosion caused by livestock.
- Maintain grade control structures necessary for stream bottom and bank stability.
- Maintain stream bank protection facilities, i.e. rock jetties, bank riprap, rock barbs, log revetments, etc.
- Maintain safety measures for protection of people and animals.
- Maintain travel-ways that provide access for operation and maintenance.

**SPECIFIC RECOMMENDATIONS FOR YOUR STREAMBANK AND  
SHORELINE PROTECTION PROJECT**



**CONTACT YOUR LOCAL NATURAL RESOURCES CONSERVATION SERVICE OFFICE FOR ANY ADDITIONAL TECHNICAL ASSISTANCE YOU MIGHT NEED FOR IMPLEMENTATION OF THIS OPERATION AND MAINTENANCE PLAN FOR YOUR STREAMBANK AND SHORELINE PROTECTION PROJECT.**

**STATEMENT OF WORK**  
**Streambank and Shoreline Protection (580)**

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

## **DESIGN**

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### **Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan.
  - b. List of required permits to be obtained by the client.
  - c. Impacts on adjacent properties and structures.
  - d. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06).
  - e. List of facilitating practices
  - f. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Geology/Soil Mechanics
    - ii. Hydrology/Hydraulics
    - iii. Structural
    - iv. Vegetation/Soil Bioengineering
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03(b) (2)).
6. Design modifications during installation as required.

## **INSTALLATION**

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### **Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used.
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

## **CHECK OUT**

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### **Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03(c) (1)).
3. Progress reporting.

**STATEMENT OF WORK**  
**Streambank and Shoreline Protection (580)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Streambank and Shoreline Protection, 580.
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**MANURE TRANSFER**

(No.)

**CODE 634**

**DEFINITION**

A manure conveyance system using structures, conduits, or equipment.

**PURPOSE**

To transfer animal manure (bedding material, spilled feed, process and wash water, and other residues associated with animal production may be included) through a hopper or reception pit, a pump (if applicable), a conduit, or hauling equipment to:

- A manure storage/treatment facility,
- A loading area, and
- Agricultural land for final utilization.

**CONDITIONS WHERE PRACTICE APPLIES**

The manure transfer component is a part of a planned manure management or comprehensive nutrient management system.

Where manure is generated by livestock production or processing and a conveyance system is necessary to transfer manure from the source to a storage/treatment facility and/or a loading area, and/or from storage/treatment to an area for utilization. This includes hauling manure from one geographical area with excess manure to a geographical area that can utilize the manure in an acceptable manner.

This practice does not include land application or other use of manure. Criteria for land application of manure are included in NRCS conservation practice standard Nutrient Management, Code 590 or Waste Utilization, Code 633.

**CRITERIA**

**General Criteria Applicable to All Purposes**

Manure transfer components shall comply with all federal, state, and local laws, rules and regulations.

**Structures.** All structures, including those that provide a work area around pumps, shall be designed to withstand the anticipated static and dynamic loading. Structures shall be designed to withstand earth and hydrostatic loading in accordance with practice standard Waste Storage Facility, Code 313. Covers, when needed, shall be designed to support the anticipated dead and live loads.

Reception pits shall be sized to contain a minimum of one full day's manure production. For reception pits collecting runoff, the reception pit shall be sized to also contain at least the volume of runoff from the 25-year, 24-hour storm. Additional capacity shall be added as needed for freeboard and emergency storage.

Openings to structures to receive manure from alley scrape collection shall be a minimum of 9 square feet with one dimension no smaller than 4 feet. The opening shall be equipped with a grate designed to support the anticipated loads.

When curbs are needed in conjunction with structures, they shall be constructed of either concrete or wood. Curbs shall be of sufficient height to ensure total manure flow into the structure and be adequately anchored.

**Pipelines.** Design of pipelines shall be in accordance with sound engineering principles considering the type of load on the pipe, exposure, etc. The minimum pipeline capacity from collection facilities to storage/treatment facilities shall be the maximum peak flow anticipated on a daily basis.

The minimum pipeline capacity from storage/treatment facilities to utilization areas shall ensure the storage/treatment facilities can be emptied within the time limits stated in the management plan for manure utilization.

Pipelines used for transferring waste to an irrigation system shall meet the requirements of NRCS conservation practice standard, Irrigation Water Conveyance, Pipeline, Code 430.

All pipes shall be designed based on the type of

material and total solids content and shall convey the required flow without plugging. Flow velocities shall be sufficient to minimize settling of solids in the pipeline.

Clean-out access shall be provided for gravity pipelines at a maximum interval of 200 feet for lines carrying non-bedded manure. For pipelines carrying bedded manure the maximum interval shall be 150 feet. Gravity pipelines shall not have horizontal curves or bends except minor deflections (less than 10 degrees) in the pipe joints unless special design considerations are used.

Where slurry manure is transferred in a gravity system, a minimum of 4 feet of head is required on the pipe system.

Gravity discharge pipes used for emptying a storage/treatment facility shall have a minimum of two gates or valves, one of which shall be manually operated.

Pipelines shall be installed with appropriate connection devices to prevent contamination of private or public water supply distribution systems and ground water.

Equipment installed to determine flow rates, shall be electromagnetic flow meters designed to measure flow of manure and installed according to the manufacturer's recommendations.

**Other Conduits.** Concrete lined ditches shall be designed in accordance with NRCS conservation practice standard Lined Waterway or Outlet, Code 468. A minimum design velocity of 1.5 feet per second shall be used.

**Pumps.** Pumps installed for manure transfer shall meet the requirements of NRCS conservation practice standard Pumping Plant, Code 533. Pumps shall be sized to transfer manure at the required system head and volume. Type of pump shall be based on the consistency of the manure and the type of bedding used. Requirements for pump installations shall be based on manufacturer's recommendations.

**Safety.** The system design shall consider the safety of humans and animals during construction and operation.

Open structures shall be provided with covers or barriers such as gates, fences, etc. Ventilation and warning signs shall be provided for manure transfer systems as necessary to warn of the danger of entry

and to reduce the risk of explosion, poisoning, or asphyxiation.

Pipelines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices where necessary to control gas entry into buildings.

Barriers shall be placed on push-off ramps to prevent tractors or other equipment from slipping into waste collection, storage, or treatment facilities.

**Biosecurity.** Manure from diseased animals shall be handled in accordance with the recommendations of the state veterinarian.

Equipment leaving the farm shall be sanitized as appropriate to prevent the spread of disease.

#### **Additional Criteria in Support of Agricultural Land for Final Utilization**

**Waste utilization.** Manure shall be applied to the utilization area in amounts, uniformity, rates, and at a time consistent with the requirements of NRCS conservation practice standard Nutrient Management Code 590 or Waste Utilization, Code 633 as appropriate.

Liquid or slurry manure shall be adequately agitated prior to transfer for the purpose of land application both on and off the farm.

Where manure is to be spread on land not owned or controlled by the producer, the manure management plan, as a minimum, shall document the amount of manure to be transferred, the nutrient content of the manure, the date of transfer, and who will be responsible for the environmentally acceptable use of the waste. Provisions shall be made to inform the receiver of the manure of the proper storage and/or utilization requirements.

**Hauling equipment.** Equipment used for hauling manure from one geographical area to another area shall be capable of hauling the manure without spillage, leakage, or wind-blown losses during transport. Hauling equipment shall meet all applicable local, state, and federal laws regarding highway transportation.

Weight limits of roads used for hauling waste shall be followed.

### **CONSIDERATIONS**

#### **General**

Consider economics (including design life), overall manure management system plans, and health and safety factors.

### **On Farm Transfer**

In locating structures, utilize existing topography to the greatest extent possible to generate head on structures and reduce pumping requirements.

Consider the operating space requirements of loading and unloading of equipment in the vicinity of the manure transfer components.

Consider the subsurface conditions, i.e., depth to bedrock, water table, etc., when locating and designing structures.

Pipelines used for transferring manure should be flushed with clean water after use.

When applicable and compatible, consider the joint use of manure transfer pipelines with irrigation system design requirements.

The pipe pressure rating required may need adjustment based on manure temperature.

Consider corrosion resistance and water tightness in the selection of pipe material and joints.

Consider the potential for salt (struvite) deposits in smaller diameter pipes.

Consider the need for appropriate check valves, anti-siphon protection and open air breaks in all pipelines.

Provisions should be made for removing solids from conveyance conduits such as concrete lined ditches, etc

### **Off Farm Transfer/Transport**

Consider route selection and timing of manure transfer to minimize impact of nuisance odors on others.

Consider equipment type and covering of manure to minimize particulate matter generation during transport of manure.

Vehicles used to transfer manure should be sized to reduce the danger of rollover.

### **Cultural Resources Considerations**

NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

### **Endangered Species Considerations**

Determine if installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates that the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

### **PLANS AND SPECIFICATIONS**

Plans and specifications for installing manure transfer systems shall be in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

### **OPERATION AND MAINTENANCE**

An Operation and Maintenance (O&M) Plan must be prepared and reviewed with the landowner or operator responsible for the application of this practice. The O&M Plan shall provide specific instructions for proper operation and maintenance of each component of this practice and shall detail the level of repairs needed to maintain the effectiveness and useful life of the practice.

The operation and maintenance plan shall describe what actions will be taken to minimize flies and other insects during the transfer of manure.

For the hauling of manure from one geographical area to another, record keeping by the producer or his/her designated representative will be required and may include such items as:

- the type, nutrient content, and amount of manure transferred,
- the solids percentage of the manure,
- the date of the transfer,
- the name and address of the source and destination of the manure, and
- the condition of the manure as left at the destination (spread, stockpiled and covered, etc.).

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD

**WATER WELL**

(No.)

**CODE 642**

**DEFINITION**

A hole drilled, dug, driven, bored, jetted or otherwise constructed to an aquifer.

**PURPOSE**

Provide water for livestock, wildlife, irrigation, human, and other uses.

Provide for general water needs of farming/ranching operations.

Facilitate proper use of vegetation on rangeland, pastures and wildlife areas.

**CONDITION WHERE PRACTICE APPLIES**

This practice applies on all land uses where the underground supply of water is sufficient in quantity and quality for the intended purpose.

This practice applies only to production wells. Specifically excluded are any types of wells installed solely for monitoring or observation purposes; injection wells; and piezometers. The standard does not apply to pumps installed in wells; above ground installations, such as pumping plants, pipelines, and tanks; temporary test wells; and decommissioning of wells (ASTM D 5299).

**CRITERIA**

**Suitability of Site.** The availability of ground water for its intended use at the site shall be determined by using reliable local experience and reviewing all available relevant geologic maps and reports; well records maintained by state and federal agencies; and design, construction, and maintenance records of nearby wells. An appropriate level of investigation, including test well drilling, is conducted on-site, as needed, prior to well construction to determine site-specific hydrogeologic conditions.

The site shall be suitable for safe operation of the drilling equipment.

**Drilling Contractors.** California State law requires that wells be constructed by contractors licensed in accordance with the provisions of the Contractors License Law (Chapter 9, Division 3, of

the Business and Professions Code) unless exempted by that act.

**Well Head Protection.** Wells shall be located at safe distances from potential sources of pollution, including unsealed abandoned wells. The allowable distance shall be based on consideration of site-specific hydrogeologic factors and shall comply with requirements of all applicable state or local regulations or construction codes.

Surface runoff and drainage that might reach the wellhead from potential areas of contamination, such as those used by livestock, shall be diverted.

Wells shall be located a safe distance from both overhead and underground utility lines and other safety hazards.

**Borehole.** Drilled, jetted, bored, and driven wells shall be sufficiently round, straight, and of adequate diameter, to permit satisfactory installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used.

**Use of Casing.** Casing shall be installed to seal out undesirable surface or shallow ground water and to support the side of the hole through unstable earth materials. The intake portion of a well through stable geologic materials may not require casing.

**Casing Diameter:** Casing diameter shall be sized to permit satisfactory installation and efficient operation of the pump, and large enough to assure that uphole velocity is 5 feet per second or less, to protect against excessive head loss.

**Materials.** Casings may be of steel, iron, stainless steel, copper alloys, plastic, fiberglass, concrete or other material of equivalent strength and durability consistent with the intended use of the water and the maximum anticipated differential head between the inside and outside of the casing.

Steel well casings shall meet or exceed requirements specified in ASTM A 589. Steel pipe manufactured for other purposes may be used if the quality of the pipe meets or exceeds requirements specified in ASTM A 589.

Only steel pipe casings shall be used in driven wells.

To prevent galvanic corrosion, dissimilar metals shall not be joined.

Plastic casings made of acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene-rubber (SR) shall conform to material, dimensional and quality requirements specified in ASTM F 480.

If the water is to be used for human consumption, plastic pipe shall be approved by the National Sanitation Foundation.

Plastic pipe manufactured for water or irrigation pipelines may be used if the quality equals or exceeds requirements specified in ASTM F 480.

Filament-wound fiberglass casings (glass-fiber-reinforced-thermosetting-resin pipe, RTRP) may be used if material meets requirements specified in ASTM D 2996. Tests for long-term cyclic pressure strength, long-term static pressure strength, and short-term rupture strength as required in ASTM D 2996 are not needed because the pipe is to be used for well casing. Joints shall meet requirements specified in section 3.8, ASTM F 480.

Fiberglass pressure pipe, (also called reinforced plastic mortar pipe, RPMP, or fiberglass pipe with aggregate) shall meet or exceed requirements specified in ASTM D 3517.

**Casing Strength.** Well casing wall thickness shall be sufficient to withstand all anticipated static and dynamic pressures imposed on the casing during installation, well development and use. Required casing strength shall be determined as shown in NEH Part 631, Chapter 33, Investigations for Ground Water Resources Development.

**Joint Strength.** Joints for well casings shall have adequate strength to carry the load due to the casing length and still be watertight, or shall be mechanically supported during installation to maintain joint integrity. Such mechanically supported casings shall terminate on firm material that can adequately support the casing weight.

**Screen.** Well screens shall be installed in any aquifer material likely to produce silt or sand. Well screens may be constructed of commercially manufactured screen sections, well points, or field-perforated sections.

The screen shall be constructed with the slot width determined from aquifer samples (Part 631, NEH, Chapter 33). Perforation by any method is

allowable provided proper slot size and entrance velocity limits can be met. Screen open areas can range from 1 percent for field-perforated screens to 25 percent or more for continuous wire-wrapped screens. To assure good well efficiency, open areas should be designed to approximate aquifer porosity. High open area percentages also make well development more effective. The length and open area of the screen shall be sized to limit entrance velocity of water into the well to less than or equal to 0.1 foot per second (Part 631, NEH, Chapter 33, Example 33-2).

Depth of the aquifer below ground surface and the thickness of aquifer to be penetrated by the well shall govern the position of the screen in the well.

Maximum drawdown shall not be permitted below the top of the highest screen or pump intake.

**Seals (Packers).** Telescoped screen assemblies shall be provided with one or more sand-tight seals between the top of the telescoped screen assembly and casing.

**Filter Pack.** Installation of a filter pack around the well screen shall be considered under the following conditions: presence of a poorly graded, fine sand aquifer; presence of a highly variable aquifer, such as alternating sand and clay layers; presence of a poorly cemented sandstone or similar aquifer; a requirement for maximum yield from a low-yielding aquifer; and holes drilled by reverse circulation.

**Pre-packed Well Screens.** For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a commercial pre-packed well screen may be substituted for a conventionally installed (by tremie) filter pack.

**Installation.** Casing shall extend from above the ground surface down through unstable earth materials to an elevation of at least 2 feet into stable material or to the top of the screen.

All wells shall be cased to a sufficient height (minimum of 12 inches) above the ground surface to prevent entry of surface and near-surface water.

Casing for artesian aquifers shall be sealed into overlying, impermeable formations in such a manner as to retain confining pressure.

If a zone is penetrated that is determined or suspected to contain water of quality unsuitable for the intended use, the zone shall be sealed to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

**Well Development.** Well development shall be performed to repair damage done to the formation by the drilling process, and to alter the physical characteristics of the aquifer surrounding the borehole so that water will flow more freely to the well.

The method of well development used shall be selected based on geologic character of the aquifer, type of drilling rig, and type of screen.

**Aquifer Development.** For massive, unfractured rock that is unresponsive to well development procedures, the use of aquifer stimulation techniques may be considered to improve well efficiency and specific capacity. Techniques may include dry ice, acidizing, explosives, or hydrofracturing, depending on the composition and structure of the formation.

**Grouting and Sealing.** The annulus surrounding the permanent well casing at the upper terminus of the well shall be filled with mortar containing expansive hydraulic cement (ASTM C 845), or bentonite-based grout. The length of the grout seal shall be no less than 10 feet and not less than the minimum specified in state or locally applicable construction codes.

The casing shall be surrounded at the ground surface by a 4-inch thick concrete slab extending at least 2 feet in all directions. The upper surface of the base shall slope away from the well casing. Contacts between the base and the annular seal, and the base and the casing, shall be water tight and shall not cause the failure of the annular seal or the well casing.

A positive seal (grouted in place) or packer shall be provided between the casing and the less pervious material overlying the aquifer of artesian wells, and in all aquifers where co-mingling of waters is undesirable.

**Access Port.** An access port with a minimum diameter of 0.5 inch shall be installed to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well. Access ports and pressure gages or other openings in the cover shall be sealed or capped to prevent entrance of surface water or foreign material into the well. Removable caps are acceptable as access ports.

**Disinfection.** Wells shall be disinfected immediately following their construction or repair to neutralize any contamination from equipment, material or surface drainage introduced during

construction. The disinfection process shall comply with all local or state requirements.

**Water Quality Testing.** Sampling and testing shall comply with all applicable federal, state and local requirements. These requirements vary according to the water quality parameters associated with the intended use(s) of the water.

**Reporting.** As required by California State law, the well drilling contractor shall complete a Well Completion Report and file it with the California Department of Water Resources (DWR), in accordance with DWR instructions available online.

## CONSIDERATIONS

The potential for adverse interference with existing nearby production wells shall be evaluated in planning.

The potential for ground water overdraft and the long-term safe yield of the aquifer shall be considered in planning.

If practicable, wells shall be located in higher ground and up gradient from sources of surface contamination or flooding. In determining gradient, both pumped and unpumped conditions shall be considered.

Potential effects of installation and operation of the well on cultural, historical, archeological, or scientific resources at or near the site shall be considered in planning.

**Cultural Resources.** NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

**Endangered Species.** Determine if installation of this practice with any others proposed will have any effect on any federal or state listed Rare, Threatened or Endangered species or their habitat.

NRCS's objective is to benefit these species and others of concern or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

California Department of Water Resources, Southern District, 1998, California Well Standards: online integration of DWR Bulletins 74-81 and 74-90 (last modified June 10, 2004), [http://www.dpla.water.ca.gov/sd/groundwater/california\\_well\\_standards/well\\_standards.html](http://www.dpla.water.ca.gov/sd/groundwater/california_well_standards/well_standards.html).

#### **PLANS AND SPECIFICATIONS**

Plans and specifications shall be prepared for specific field sites in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended uses.

#### **OPERATION AND MAINTENANCE**

A plan for maintenance of a well shall be prepared. The well construction records shall be kept on file with the maintenance plan by the owner/operator. As a minimum, the plan shall include a statement of identified problems, corrective action taken, date, and specific capacity (yield per unit drawdown) of well before and after corrective action was taken.

#### **REFERENCES**

USDA-NRCS, Nov. 1998, Investigations for Ground Water Resources Development: National Engineering Handbook, Part 631, Chapter 33, <http://www.info.usda.gov/CED/ftp/CED/neh631-33.pdf>.

California Department of Water Resources, Nov. 1999, How to Fill Out a Well Completion Report: DWR Instruction Manual by Carl Hauge, 29 p., [http://www.dpla.water.ca.gov/sd/groundwater/publications/wcr\\_instruction\\_pamphlet.pdf](http://www.dpla.water.ca.gov/sd/groundwater/publications/wcr_instruction_pamphlet.pdf).

U.S DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE  
CALIFORNIA

**PRACTICE REQUIREMENTS  
FOR  
642 – WATER WELL**

For: Business Name \_\_\_\_\_  
Job Location \_\_\_\_\_  
County \_\_\_\_\_ RCD \_\_\_\_\_ Farm/Tract No. \_\_\_\_\_  
Referral No. \_\_\_\_\_ Prepared By \_\_\_\_\_ Date \_\_\_\_\_

**IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.**

Installation shall be in accordance with the following drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF THE NRCS TECHNICIAN.

1. Drawings, No. \_\_\_\_\_
2. Practice Specifications \_\_\_\_\_
3. Type of Casing: \_\_\_\_\_ Size \_\_\_\_\_ in; Wall thickness \_\_\_\_\_ in.
4. Length of casing \_\_\_\_\_ length of perforated section \_\_\_\_\_
5. Type and size of perforations: \_\_\_\_\_
6. Gravel Pack gradation: \_\_\_\_\_
7. Special Requirements: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
8. Special Maintenance Requirements: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**PRACTICE APPROVAL:**

Job Classification: (Ref: Section 501 NEM)

Show the limiting elements for this job. This job is classified as, Class \_\_\_\_\_

Limiting elements:	Units
<u>Depth of well</u> _____	_____ ft
<u>Yield</u> _____	_____ cfs
_____	_____
_____	_____

Design Approved by: \_\_\_\_\_ Date: \_\_\_\_\_

**LANDOWNER'S/OPERATOR'S ACKNOWLEDGEMENT:**

The landowner/operator acknowledges that:

- a. He/she has received a copy of the drawings and specification, and that he/she has an understanding of the contents, and the requirements.
- b. He/she has obtained all the necessary permits.
- c. No changes will be made in the installation of the job without prior concurrence of the NRCS technician.
- d. Maintenance of the installed work is necessary for proper performance during the project life.

Accepted by: \_\_\_\_\_ Date: \_\_\_\_\_

**PRACTICE COMPLETION:**

I have made an on site inspection of the site (or I am accepting owner/contractor documentation), and have determined that the job as installed does conform to the drawings and practice specifications.

Completion Certification by:

/s/ \_\_\_\_\_ Date \_\_\_\_\_

UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE

**642 – WATER WELL**

**OPERATION AND MAINTENANCE**

Sponsor/Land user: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Location GPS Coordinates Map Datum: \_\_\_\_\_ E \_\_\_\_\_ N \_\_\_\_\_

Quad Sheet Name \_\_\_\_\_ SEC \_\_\_\_\_ T \_\_\_\_\_ R \_\_\_\_\_

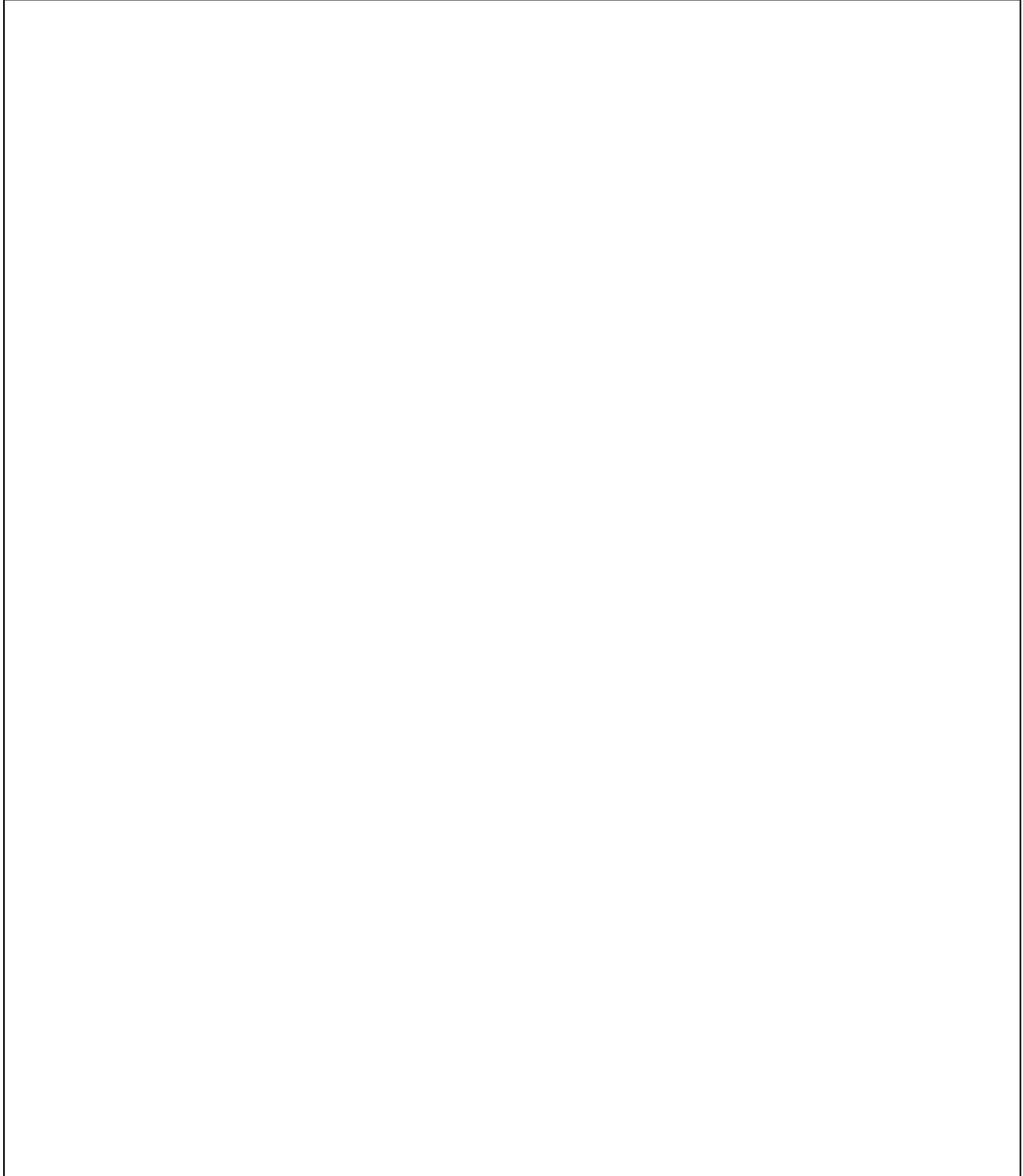
A properly operated and maintained well is an asset to the farm. This well was designed and installed to provide beneficial use of subsurface water. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program:

**GENERAL RECOMMENDATIONS**

- Maintain the well cover securely in place.
- Protect the area from being damaged by agriculture machinery, vehicles, or livestock.
- All fences, railings, and/or warning signs shall be maintained to provide warning and/or prevent unauthorized human or livestock entry.
- Do not allow any foreign debris to accumulate in the immediate vicinity.
- Maintain soil and vegetative covering to the design conditions.
- Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate corrective actions to alleviate further damage.
- Check metal surfaces for rust and other damage especially sections in contact with earthfill and with other materials. Repair or replace damaged section and apply paint as a protective covering.
- Keep all surface water from entering or accumulating at the immediate vicinity of the well site.
- Immediately repair any vandalism, vehicular, or livestock damage.

**SPECIFIC RECOMMENDATIONS FOR YOUR WATER WELL**



**CONTACT YOUR LOCAL NATURAL RESOURCES CONSERVATION SERVICE OFFICE FOR ANY ADDITIONAL TECHNICAL ASSISTANCE YOU MIGHT NEED FOR IMPLEMENTATION OF THIS OPERATION AND MAINTENANCE PLAN FOR YOUR WATER WELL.**

**STATEMENT OF WORK**  
**Water Well (642)**

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

**DESIGN**

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**Deliverables:**

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
  - a. Practice purpose(s) as identified in the conservation plan.
  - b. List of required permits to be obtained by the client.
  - c. Impacts on adjacent properties and structures.
  - d. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06).
  - e. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    - i. Hydrogeology
    - ii. Wellhead Location and Protection
    - iii. Materials
    - iv. Environmental Considerations (e.g. water quality)
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03(b) (2)).
6. Design modifications during installation as required.

**INSTALLATION**

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**Deliverables**

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
  - a. Actual materials used.
  - b. Inspection records
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

**CHECK OUT**

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**Deliverables**

1. As-Built documentation.
  - a. Extent of practice units applied
  - b. Drawings
  - c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03(c) (1)).
3. Progress reporting.

**STATEMENT OF WORK**  
**Water Well (642)**

**REFERENCES**

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- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard - Water Well, 642.
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**901 - CONCRETE**

**I. SCOPE**

Concrete work shall consist of furnishing and placing concrete to the dimensions, lines and grades as shown on the drawings. Concrete strength shall be 3,000 psi at 28 days or as specified in the Construction Requirements. Proportioning given below will be accepted as meeting this strength requirement.

**II. MATERIALS**

**Cement**

Portland cement shall conform to the requirements of ASTM Designation of C-150 and shall be Type II unless otherwise specified in the "Practice Requirements" sheet and shall be free of lumps and partially set masses.

**Water**

Shall be free from acid, alkali, oils or organic matter.

**Aggregate**

Shall be clean, hard, strong and durable, free from dirt and other substances deleterious to concrete. The fine and coarse aggregates shall be a well-graded mix approved by the Engineer. The maximum size of aggregate shall not exceed one and a half inches and conform to the requirements of ASTM C-33.

**Entrained Air**

May be used; however, the air content shall not be more than six percent.

**Reinforcing Steel**

Reinforcing steel shall be deformed bars conforming to the requirements of ASTM Designation A-615 or A-996. Fabricated deformed steel bar mats shall conform to ASTM Designation A-184.

Plain steel welded wire fabric reinforcement shall conform to ASTM Designation A-185. Deformed steel welded wire fabric shall conform to ASTM Designation A-497. All reinforcing shall conform to the sizes and shapes shown on the drawings.

**III. PROPORTIONING**

Concrete shall be proportioned to include not more than six gallons of water per sack of cement or less than five and one half sacks of cement per cubic yard of concrete. Consistency of the concrete shall allow it to be worked into place without segregation and the slump shall be 3 inches  $\pm$  1/2 inch.

When ready-mixed concrete is furnished, the supplier will provide the owner a delivery ticket that shows: time of loading; quantity of materials used, including water and any admixtures; revolution counter reading at time of loading.

**IV. MIXING**

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1-1/2 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 or more than 100. Each batch shall be completely discharged before the mixer is recharged.

**V. FORMS**

Forms shall conform to the shapes, lines, and dimensions as shown on the drawings. They shall be braced and/or tied together so as to maintain position and shape and be sufficiently tight to prevent leakage of mortar. Forms shall be thoroughly covered with a form release agent or wetted and cleaned of debris prior to placement of concrete.

Forms shall not be removed without the approval of the Engineer.

**VI. PLACEMENT**

Concrete shall not be placed until the subgrade, forms, and reinforcing steel have been inspected by the Engineer.

Items to be embedded in the concrete shall be positioned accurately and firmly anchored to prevent displacement during placement of concrete.

All reinforcement at the time of placement shall be free from rust, oil, grease, paint or other deleterious matter.

The concrete shall be deposited as closely as possible to its final position and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. The deposition of concrete shall be regulated so that the concrete may be consolidated with a minimum of lateral movement.

Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation.

Consolidation of concrete may be accomplished by means of internal type mechanical vibrators, rodding, spading, or hand tamping.

### **VII. CONSTRUCTION JOINTS**

Construction joints shall be provided as shown in the drawings or as approved by the Engineer. Joints shall be thoroughly cleaned and laitance removed before a new placement is made. Each joint shall be wetted immediately before the placing of new concrete.

### **VIII. FINISHING**

After the concrete has been consolidated, the unformed surfaces shall be given a float finish.

Immediately after form removal, formed surfaces shall be cleaned of all fins and irregular projections from exposed surfaces. All defective concrete shall be removed and effectively repaired.

### **IX. PROTECTION AND CURING**

Concrete shall be prevented from drying for a curing period of at least seven days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period. Moisture shall be maintained by sprinkling, flooding, or fog spraying or by covering with continuously moistened canvas, burlap, cloth mats, straw earth or other approved material. For formed surfaces, the protection may be accomplished by leaving the forms in place and keeping them wet for the entire curing period. In lieu of water curing, the concrete shall be protected by spraying with an approved curing compound. The curing compounds shall be applied in an approved manner immediately after the concrete is finished. All surfaces shall be kept moist until the compound is applied.

The curing compound shall be applied at the rate of one gallon per 175 square feet.

### **X. CONCRETING IN COLD WEATHER**

Before any concrete is placed, all ice, snow, and frost shall be completely removed from all surfaces to be in contact with the new concrete, and the temperature of these surfaces shall be raised to as close as may be practical to the temperature of the new concrete that is

to be placed thereon. No concrete shall be placed on a frozen subgrade or on one that contains frozen materials.

When the atmospheric temperature may be expected to drop below 40°F at the time concrete is placed, or at any time during the curing period, the following provisions also shall apply:

- A. The temperature of the concrete at the time of placing shall not be less than 50° F or more than 90° F. The temperature of neither aggregates nor mixing water shall be more than 100° F just prior to mixing the cement.
- B. When the daily minimum temperature is less than 40° F, mortar shall be insulated or housed and heated after placement. The temperature of the concrete and air adjacent to the mortar shall be maintained at not less than 50° F or more than 90° F for the duration of the curing period.
- C. Methods of insulating, housing and heating the structure shall conform to "Recommended Practice for Cold Weather Concreting", ACI Standard 306.
- D. The use of accelerators or antifreeze compounds will not be allowed.
- E. When dry heat is used protect concrete, means of maintaining an ambient humidity of at least 40 percent shall be provided unless the concrete has been coated with a curing compound or is covered tightly with an approved impervious material.

### **XI. CONCRETING IN HOT WEATHER**

When climatic or other conditions are such that the temperature of concrete may reasonably be expected to exceed 90° F at the time of placement, or during the first 24 hours after placement, the following provisions also shall apply:

The temperature of the concrete shall be maintained below 90° F during mixing, conveying, and placing. Methods used shall conform to "Recommended Practice for Hot Weather Concreting", ACI Standard 305.

Exposed concrete surfaces that tend to dry or set too rapidly shall be continuously moistened by means of fog sprays or otherwise protected from drying immediately after placement.

Concrete surfaces exposed to the air shall be covered as soon as the concrete has hardened sufficiently and shall be kept continuously wet for at least the first 24 hours of the curing period, and for the entire curing period unless curing compound is applied as specified in Section IX.

If moist curing is discontinued before the end of the curing period, curing compound shall be applied immediately.

## **XII. STRUCTURE DRAINAGE**

Graded sand and gravel filters or filter drains shall be constructed as shown on the drawings or as staked in the field.

Trenches for the filter drains shall be excavated to lines, shape and dimensions shown on the drawings. The sand and gravel shall be placed and tamped in place to the dimensions shown. When drainpipes are used, they will be installed on line and grade without displacement due to placement of filter material.

The filter material shall conform to the following gradation unless otherwise specified.

<u>U.S. Standard Sieve Size</u>	<u>Percent Passing</u>
2"	85-90
3/4"	50-90
No. 16	15-50
Less Than No. 16	0-15

## **XIII. STRUCTURAL BACKFILL**

The work shall consist of all earthfill adjacent to the structures.

### **Materials**

The fill materials shall be the in place excavated materials unless otherwise stated in the "Practice Requirements" sheet and shown on the drawings.

### **Placement**

The fill shall be placed so that the distribution of materials will be to the limits shown on the drawings and shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. No fill shall be placed upon a frozen surface nor shall snow, ice or frozen material be incorporated in the fill.

Fill shall not be placed until the following time has elapsed after concrete placement:

Walls or slabs	14 Days
Conduits, Precast, Cradles	2 Days
Conduits, Precast, Bedded	1 Day
Antiseep Collars	3 Days

The fill shall be placed in a manner adequate to prevent damage to the structure and allow the structure to gradually and uniformly assume the backfill loads. The fill shall be placed in not more than four-inch layers.

## **Moisture Content**

The soil moisture of the fill material shall be sufficient to hold a ball shape when squeezed in the hand, unless otherwise stated and shown on the drawings.

## **Compaction**

The fill material shall be compacted to a density equal to that of the adjacent materials. Compaction shall be accomplished by hand tampers or other acceptable means excluding heavy equipment. Heavy equipment shall not be operated within two feet of any structure.

The passage of heavy equipment will not be allowed over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one half the clear span width of the structure or pipe or two feet, whichever is greatest.

## **XIV. SURFACE DRAINAGE**

After completion of the backfill operations, the surface area adjacent to and around the structures shall be graded to convey surface runoff away from the structure.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**902 - CONCRETE BLOCK STRUCTURE**

**I. SCOPE**

The work shall consist of constructing concrete block structure(s) complete with appurtenances to the, dimensions lines, grades and locations as shown on the drawings.

**II. MATERIALS**

Masonry units shall be Class (1) nominal weight, Type I, units conforming to the ASTM Designation C-90 and, in addition, the requirements of the Quality Control Standards of the Concrete Masonry Association.

Portland Cement shall conform to ASTM Designation C-150.

Mortar shall be freshly prepared and uniformly mixed in the ratio by volumes of 1 part cement, 1/2 part lime putty, 4 1/2 parts sand, and shall conform to ASTM Designation C-270. If plastic type cement is used, the lime putty shall be omitted.

Grout shall be of fluid consistency and mixed in the ratio by volumes, one part cement, three parts sand, or one part cement, three parts sand, two parts pea-gravel. All voids in the structure shall be filled unless otherwise specified in the "Practice Requirements" sheet.

Reinforcing steel shall be deformed bars conforming to ASTM Designations A-615, A-996 except that 1/4-inch ties may be plain bars. Welded wire reinforcement shall conform to ASTM Designation A-185. All reinforcing shall conform to the sizes and shapes shown on the drawings.

**III. FOUNDATION**

Concrete foundations and floors shall be placed in conformance with California Construction Specification-901-CONCRETE.

**IV. PLACEMENT**

No blocks are to be placed until the subgrade and/or foundation has been inspected by the Engineer. When concrete foundations are required, the concrete shall be placed in conformance with California Conservation Construction Specification - 901-CONCRETE.

A mortar key shall be provided between the first row of blocks and the footing (or floor slab). Usually a depressed 2x4 section is used, or depressing the first row of blocks into the freshly placed concrete.

The blocks shall be laid true and plumb to the dimensions shown on the drawings. All horizontal and vertical joints shall be full-mortared and bonded well to both units.

Reinforcing steel shall be placed as detailed on the drawings. When continuous steel bars cannot be used, a lap or splice of 30-bar diameter may be used.

The completed job shall be workmanlike and present a good appearance.

**V. STRUCTURAL BACKFILL**

The work shall consist of all earth backfill adjacent to the structures. Drainage system of weepholes and drain material shall be installed as shown on the drawings: The gradation of the drainfill shall conform to the requirements stated on the drawings or on the "Practice Requirement" sheet.

**Materials**

The fill materials shall be the in-place excavated material unless otherwise stated and shown on the drawings, however all fill shall contain no rocks greater than 2 inches and no undesirable materials.

**Placement**

The fill shall be placed so that the distribution of materials will be to the limits shown on the drawings and shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material.

No fill shall be placed upon a frozen surface nor shall snow, ice or frozen material be incorporated in the fill.

No fill shall be placed until the following time has elapsed after concrete placement:

Walls or slabs	14 days
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The fill shall be placed in a manner adequate to prevent damage to the structure and allow the structure to gradually and uniformly assume the backfill loads. The fill shall be placed in not more than four-inch layers.

**Moisture Content**

The soil moisture of the fill material shall be sufficient to hold a ball shape when squeezed in the hand, unless otherwise stated and shown on the drawings.

**Compaction**

The fill material shall be compacted to a density equal to that of the adjacent materials. Compaction shall be accomplished by hand tampers or other acceptable means excluding heavy equipment. Heavy equipment shall not be operated within two feet of any structure.

**V. SURFACE DRAINAGE**

After completion of the backfill operations, the surface area adjacent to and around the structure shall be graded to convey surface runoff away from the structure.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**903 – EARTHFILL**

**I. SCOPE**

The work shall consist of borrow excavation, hauling, placing and compacting earthfills required to construct the earthfills as shown on the drawings, or as staked in the field.

**II. SUBGRADE PREPARATION**

Subgrades for earthfill shall be stripped to remove vegetation and other unsuitable materials. The subgrade surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface materials of the subgrade shall be compacted and bonded with the first layer of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to ensure a good bond between the fill and the abutments. Subgrade and abutment surfaces shall not steeper than 1 horizontal to 1 vertical.

The sites of the borrow area shall be stripped to sufficient depth to remove all vegetation, roots, brush, sod and other objectionable material. Clearing and disposal methods shall be in accordance with applicable state and county laws with due regards to the safety of persons and property.

**III. EXCAVATION**

**Excavated Material**

To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earthfill. The suitability of materials for specific purposes will be determined by an Engineer.

All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of at the locations shown on the drawings or at sites remote from the project.

**Borrow Excavation**

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as shown on the drawings.

Borrow pits shall be excavated and finally dressed in manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions, and shall be free draining of any water ponding.

**Bracing and Shoring**

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations.

**Structure or Trench Excavation**

Structure or trenched excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earthfill is placed or any piles are driven within the limits of the excavation.

**IV. PLACEMENT**

**Material**

All material shall be obtained from selected areas as shown on the drawings. Fill materials shall contain no sod, brush, roots, or other perishable or unsuitable material. Cobbles and rock fragments over 3 inches in diameter shall be removed from the material prior to compaction and be disposed of or placed in areas designated.

Fill shall not be placed until the required excavation and subgrade preparation has been completed. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed 8-inches. Materials placed by dumping in piles or windows shall be spread uniformly to not more than the specified thickness before being compacted. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

Fill placed around structures will be brought up to approximately uniform height on all sides of the structure.

The distribution and gradation of materials throughout the fill shall have no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. If zoned fills of substantially differing materials are specified; the zones shall be placed according to lines and grades shown on the drawings.

#### **V. CONTROL OF MOISTURE CONTENT**

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained. The material should maintain a ball shape when squeezed in the hand. When specified, the moisture shall be maintained within 2 percentage points of optimum as determined by ASTM D-698, and as specified on the "Practice Requirements" sheet.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Uniform moisture distribution shall be obtained by disking. Material that is too wet when deposited on the fill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted fill or a subgrade or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond, it shall either be removed or scarified and moistened to an acceptable moisture content prior to placement of the next layer of fill.

The proper moisture content for compaction will be determined by inspection during the placement operation.

#### **VI. COMPACTION**

Construction equipment shall be operated over each layer of fill to ensure that the required compaction is obtained. Special equipment shall be used if needed to obtain the required compaction. Compaction shall meet the requirements of the method specified on the "Practice Requirements" sheet and as described below:

1. Sheepsfoot roller - The roller shall have staggered, uniform spaced tamping feet and be equipped with suitable cleaners. The weight of the roller shall not be less than 2,500 pounds per foot of width. The maximum speed shall be less than 3 miles per hour. The entire surface of each layer placed shall receive 4 passes of this equipment.
2. Pneumatically tired equipment. A loaded scraper shall be considered a pneumatic roller. The use of this equipment must pass over 90 percent of the surface of each lift before a new lift placed. The entire surface of each layer shall receive 6 passes of this equipment.
3. Track Laying Equipment (bulldozer). The tracks of the equipment must pass over 90 percent of the surface of each lift before a new lift placed. The entire surface of each layer shall receive 8 passes of this equipment.
4. Compaction shall result in densities equal to or greater than 95 percent of the maximum obtained by laboratory compaction at optimum moisture of like soils in accordance with the procedures given in ASTM D-698, Method A.
5. Compaction shall result in densities equal to or greater than 90 percent of the maximum obtained by laboratory compaction at optimum moisture of like soils in accordance with the procedure given ASTM D-1557, Method A.

Heavy compaction equipment shall not be operated within 2 feet of any structure. The passage of heavy equipment will not be allowed:

- (1) Over cast-in-place conduits within 14-days after placement of the concrete
- (2) Over cradled or bedded precast conduits within 7 days after placement of the concrete cradle or bedding
- (3) Over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater, except as may be specified in the "Practice Requirements sheet

Fill adjacent to structures, pipe, conduits, and anti-seep collars shall be compacted to a density equivalent to that of the surrounding fill by means of hand tampers or plate vibrators. Hand directed tampers or compactors shall be used on areas not accessible to heavy compaction equipment, fills compacted in this manner shall be placed in layers not greater than 4 inches in thickness before compaction, and shall meet the same density requirement as for the adjacent area.

Compaction of backfill adjacent to structures shall not be started until after the expiration of the following minimum time interval after placement of the concrete:

Counterforts, vertical or near-vertical walls with earth loading on one side only	14 days
Walls and counterforts, backfilled on both sides simultaneously	7 days
Anti-seep, collars, conduits, and cantilever outlet bents	3 days

#### **VII. TESTING**

During the course of the work, tests may be made to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density of fill in place. These test results will be used to verify that the fills conform to the requirements of the specifications. Such tests are not intended to provide information required for the proper execution of the work and shall not relieve the Landowner, of the necessity to perform tests for the purpose.

Fill not meeting the specified requirements shall be reworked or removed and replaced with acceptable fill.

#### **VIII. FINISH**

After the placement of the earthfills, and spoils the sides and top shall be dressed by final passage of compaction equipment or by dragging to give a smooth surface. The surface area shall be graded to provide surface drainage to flow to desired locations.

#### **IX. VEGETATIVE COVER**

Unless otherwise specified, on the "Practice Requirements" sheet, a protective cover of vegetation shall be established on all disturbed areas. The planting of vegetative materials shall conform to the requirements of Practice Specification 342, Critical Area Planting.

#### **X. SPECIAL MEASURES**

Measures and construction methods shall be incorporated as needed and practical that enhances fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food, and den trees.

#### **XI. CONSTRUCTION OPERATIONS**

Construction operations shall be done in such a manner that erosion and air and water pollution are minimized and held within legal limits. The owner, operator, contractor or other persons will conduct all work and operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

The completed job shall be workmanlike and present a good appearance.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**904 - GABIONS**

**1. SCOPE**

This work shall consist of furnishing, assembling, and installing rock filled wire mesh gabion baskets for an installation as shown on the drawings or as staked in the field.

**II. MATERIALS**

**Gabions**

Gabions shall be fabricated, assembled and installed in accordance with the nominal wire sizes and dimensions found in Tables 1 and 2, using the following materials.

Woven Mesh Nonraveling, double twisted, hexagonal wire mesh consisting of two wires twisted together in two 180-degree turns. Wire for fabrication and assembly shall be hot-dipped galvanized. The wire shall have a minimum tensile strength of 60,000 psi. Galvanized steel wire shall conform to ASTM A 641, Class 3 Coating, Soft Temper.

Welded Mesh Welded-wire mesh with a uniform square or rectangular pattern and a resistance weld at each intersection. The welded wire connections shall conform to the requirements of ASTM A 185, including wire smaller than W1.2 (0.124 in.), except that the welded connections shall have a minimum average shear strength of 70 percent and a minimum shear strength of 60 percent of the minimum ultimate tensile strength of the wire

All gabion wire shall be Epoxy or Polyvinyl Chloride (PVC) coated. The galvanized wire shall be coated by fusion bonded epoxy; or fusion bonded, extruded, or extruded and bonded PVC material. The wire coating shall be colored black, gray, green or silvery; and the initial properties of the PVC coating shall meet the following requirements

- (a) Specific Gravity. In the range of 1.30 to 1.40, ASTM D 792.
- (b) Brittleness Temperature. Not higher than 15° F, ASTM D 746.
- (c) Tensile Strength. Extruded Coating (not less than 2,980 psi. ASTM D 412). Fusion Bonded Coating (not less than 2,275 psi. ASTM D 638).

- (d) Modulus of Elasticity. Extruded Coating (not less than 2,700 psi. at 100 percent strain, ASTM D 412). Fusion Bonded Coating (not less than 1980 psi. at 100 percent strain, ASTM D 638).
- (e) Ultraviolet light exposure. An exposure period of not less than 3,000 hours at 63 degrees centigrade, ASTM G 152
- (f) Salt Spray Test. A test period of not less than 3000 hours, ASTM B 117.

After the exposure to ultraviolet light and the salt spray test as specified above, the PVC coating shall not show cracks, blisters, splits, nor noticeable change of coloring (surface chalk). In addition, the specific gravity shall not change more than six (6) percent, tensile strength shall not change more than 25 percent, and modulus of elasticity shall not change more than 25 percent from their initial values.

The wire sizes shown in Tables 1 and 2 are the size of the wire after galvanizing and before coating with PVC.

Spiral binders are the standard fastener for welded-mesh gabion baskets and mattresses, and shall be formed from wire meeting the same quality and coating thickness requirements as specified for the gabion baskets and mattresses.

Alternate fasteners for use with wire mesh gabions, such as ring fasteners, shall be formed from wire meeting the same quality and coating thickness requirements as specified for the gabions and, as a minimum, shall conform to the manufacturer's recommendations. Hog rings are not acceptable

Standard fasteners and alternate fasteners must provide a minimum strength of 1,400 lb. per lineal foot for gabion baskets and 900 lb. per lineal foot for gabion mattresses. When used to interconnect gabion baskets or mattresses with PVC coating, ring fasteners shall be made of stainless steel and spiral fasteners will be PVC coated. All fasteners shall meet all of the closing requirements of the gabion manufacturer in addition to any requirements specified the "Practice Requirements" sheet.

**TABLE 1 (Minimum Requirements)\***  
**GABION BASKETS--Height 12, 18, or 36 Inches; Length as Specified**

Type of Wire *	Mesh Size Inches	Wire Diameter Inches	PVC Coating Inches	Total Diameter Inches	Galvanized Coating oz./SF
Woven Mesh	3-1/4 x 4-1/2	0.118	None	0.118	0.80
	3-1/4 x 4-1/2	0.105	0.02	0.145	0.80
Selvage		0.153	None	0.153	0.80
		0.132	0.02	0.172	0.80
Lacing and Internal Connecting Wire		0.086	0.02	0.126	0.70
Welded Mesh	3 x 3	0.118	None	0.118	0.80
	3 x 3	0.105	0.02	0.145	0.80
Spiral Binder		0.105	0.02	0.145	0.80

NOTE: The wire sizes and PVC coating thickness shown are nominal sizes.  
The wire sizes include the galvanizing coating thickness.

**TABLE 2 (Minimum Requirements)\***  
**GABION MATTRESSES--Height 6, 9, or 12 Inches; Length as Specified**

Type of Wire *	Mesh Size Inches	Wire Diameter Inches	PVC Coating Inches	Total Diameter Inches	Galvanized Coating oz./SF
Woven Mesh	2-1/2 x 3-1/4	0.086	0.02	0.126	0.70
Selvage		0.105	0.02	0.145	0.80
Lacing and Internal Connecting Wire		0.086	0.02	0.126	0.70
Welded Mesh	1-1/2 x 3	0.080	0.02	0.120	0.70
Spiral Binder		0.105	0.02	0.145	0.80

NOTE: The wire sizes and PVC coating thickness shown are nominal sizes.  
The wire sizes include the galvanizing coating thickness.

## Rock

Rock shall be sound, dense and durable with a bulk specific gravity of not less than 2.5. Rock gradation shall conform to that specified below:

Gabion Basket or Mattress	Predominant Rock Size Inches	Min. Rock Dimension Inches	Max. Rock Dimension Inches
12, 18, or 36 Inch Basket	4 to 8	4	8
6, 9, or 12 Inch Mattress	3 to 6	3	6

The greatest dimension of the rock shall not be greater than 2 times the least dimension. The engineer will inspect the rock gradation after it has been placed in the gabion baskets. At least 85 percent of the rock particles, by weight, shall be within the predominant rock size range.

### III. FOUNDATION PREPARATION

The foundation on which the gabions are to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. Surface irregularities, loose material, vegetation, and all foreign matter shall be removed from foundations. When fill is required, it shall consist of materials conforming to the specified requirements. Gabions and bedding or specified geotextiles shall not be placed until the foundation preparation is completed, and the subgrade surfaces have been inspected and approved by the Engineer.

### IV. FILTER LAYER OR BEDDING

When filter layers or bedding are specified in the "Practice Requirements" sheet, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished free of mounds, dips or windrows.

### V. ASSEMBLY AND PLACEMENT

The assembly and placement of gabions shall be in accordance with the following procedures:

**Assembly.** Rotate the gabion panels into position and join the vertical edges with fasteners for gabion assembly. Where lacing wire is used, wrap the wire with alternating single and double half-hitches at 4- to 5-inch intervals. Where spiral fasteners are used for welded-wire mesh, crimp the ends to secure the spirals in place. Where ring type alternate fasteners are used for basket assembly, install the fasteners at a maximum

spacing of 6 inches. Use the same fastening procedures to install interior diaphragms where they are required.

Interior diaphragms will be required where any inside dimension exceeds three (3) feet. Diaphragms will be installed to assure that no open intervals are present that exceeds three (3) feet.

**Placement.** Place the empty gabions on the foundation and interconnect the adjacent gabions along the top, bottom, and vertical edges using lacing wire. Wrap the wire with alternating single and double half-hitches at 4- to 6-inch intervals. Unless otherwise specified in, the Practice Requirements sheet, lacing wire will be the only fastener allowed for interconnecting woven mesh gabions. Spiral fasteners are commonly used for the assembly and interconnection of welded mesh gabions. Spirals are screwed down at the connecting edges then each end of the spiral is crimped to secure it in place. Lacing may be used as needed to supplement the interconnection of welded mesh gabions, and the closing of lids.

Interconnect each layer of gabions to the underlying layer of gabions along the front, back, and sides.

Stagger the vertical joints between the gabions of adjacent rows and layers by at least one-half of a cell length.

### VI. FILLING OPERATION

After adjacent empty woven wire gabion units are set to line and grade and common sides properly connected, they shall be placed in straight-line tension and stretched to remove any kinks from the mesh and to gain a uniform alignment. Welded-mesh gabions do not require stretching. The gabions may be staked to maintain the established proper alignment before the rock is placed. No stakes shall be placed through geotextile material. Connecting lacing wire and other fasteners (as allowed) shall be attached during the filling operation to preserve the strength and shape of the structure.

Internal connecting cross-tie wires shall be placed in each unrestrained gabion cell of more than 18 inches in height, including gabion cells left temporarily unrestrained. Two internal connecting wires shall be placed concurrently with rock placement, at each 12-inch interval of depth. In woven mesh gabions these cross-ties will be placed evenly spaced along the front face and connecting to the back face. All cross-tie wires shall be looped around two mesh openings and each wire end shall be secured by a minimum of five 180-degree twists around itself after looping.

In welded mesh gabions these cross-ties or stiffeners are placed across the corners of the gabions (at 12 inches from the corners) providing diagonal bracing. Lacing wire or preformed hooked wire stiffeners may be used.

The gabions shall be carefully filled with rock, either by machine or hand methods, ensuring alignment, avoiding bulges, and providing a compact mass that minimizes voids. Machine placement will require supplementing with handwork to ensure the desired results. The cells in any row shall be filled in stages so that the depth of rock placed in any one cell does not exceed the depth of rock in any adjoining cell by more than 12 inches. Along the exposed faces, the outer layer of stone shall be carefully placed and arranged by hand to ensure a neat, compact placement with a uniform appearance

The last layer of rock shall be uniformly leveled to the top edges of the gabions. Lids shall be stretched tight over the rock filling using only approved lid closing tools as necessary. The use of crowbars or other single point leverage bars for lid closing is prohibited as they may damage the baskets. The lid shall be stretched until it meets the perimeter edges of the front and end panels. The gabion lid shall then be secured to the sides, ends, and diaphragms with spiral binders, approved alternate fasteners, or lacing wire wrapped with alternating single and double half-hitches in the mesh openings.

Any damage to the wire or coatings during assembly, placement and filling shall be repaired promptly in accordance with the manufacturer's recommendations or replaced with undamaged gabion baskets.

## **VII. VEGETATIVE COVER**

Unless otherwise specified in the "Practice Requirements" sheet, a protective cover of vegetation shall be established on the disturbed area. The planting of vegetative materials shall conform to the requirements of Practice Specification 342, Critical Area Planting.

## **VIII. SPECIAL MEASURES**

Measures and construction methods shall be incorporated as needed and practical that enhances fish and wildlife values. Special attention shall be given to protecting visual and maintaining key shade food and den trees.

## **IX. CONSTRUCTION OPERATIONS**

Construction operations shall be done in such a manner that erosion and air and water pollution are minimized and held within legal limits. The owner, operator, Contractor or other persons will conduct all work and operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

The completed job shall be workmanlike and present a good appearance.

## **OPERATION AND MAINTENANCE ITEMS**

A properly maintained gabion structure is an asset to your farm. The life of this installation can be assured and usually increased by developing and carrying out a good maintenance program.

This will require you to perform periodic maintenance inspections. Here are some recommendations to help you develop a checklist of items to observe and to perform necessary maintenance:

Re-tie any breaks in baskets.

Replace any rocks that may have been removed.

Repair any locations due to settlement as differential settlement.

Removal any debris that may accumulate.

Repair any damage due to vandalism, vehicular, or livestock.

Other items specific to your project are listed on the "Practice Requirement" sheet.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**905 - GEOTEXTILE FABRIC**

**I. SCOPE**

The work shall consist of furnishing and installing geotextile fabric at the locations shown on the drawings.

**II. MATERIALS**

Geotextile fabrics shall consist of commercial grade of woven or nonwoven synthetic polymeric filament fibers that are formed into a stable network. They shall be resistant to soil chemicals, mildew, rodents and insects. Fibers shall contain stabilizers and/or inhibitors to enhance resistance to ultraviolet light. Fabrics are classified according to the following types:

1a - Woven Monofilament

1a - Non-Woven Bonded

2a - Non-Woven Needle punched

The type of fabric required and the specific physical properties shall be as indicated on the "Practice Requirements" sheet.

The physical properties of the fabric shall conform to the requirements listed in Table 1, for Woven Geotextiles and Table 2 for Non-woven geotextiles. The fabric shall be protected from deterioration by ultraviolet light.

Securing Pins used to secure the filter fabric in place shall be steel or fiberglass. Each pin shall be formed as an "U", "L", or "T" shapes or contain "ears" to prevent total penetration. Grommets or steel washers with an outside diameter of 1½ inches shall be provided for all but "U" shaped securing pins.

**III. Installation**

The surface on which the geotextile is to be placed shall be graded to the neat lines and grades as shown on the drawings. The surface shall be reasonably smooth and free of loose rock and clods, holes, depressions, projections, muddy conditions and standing or flowing water. The fabric shall be placed and loosely laid over the surface smoothly.

The fabric panels shall be overlapped a minimum of 18 inches for vertical laps and 24 inches for horizontal laps. The fabric shall be placed parallel to the direction of flow. It shall be placed so that the upstream end or higher panel will be placed under the downstream or lower panel.

When the fabric is used in application for wave action, the panel should be placed up and down the slope.

At vertical laps, securing pins shall be inserted through both layers along a line through the approximate midpoint of the overlap. At horizontal laps, securing pins shall be inserted through the bottom layer only. The pins shall be placed at not greater than 12-foot intervals. Securing pins shall be placed along a line approximately 2 inches in from the edge of the outer limits of the completed filter cloth area at intervals not greater than 12 feet. Additional pins shall be installed as necessary to prevent any slippage of the fabric, regardless of location.

Fabric damaged or displaced before or during installation or during placement of overlying layers of riprap shall be replaced or repaired to the original design and as approved by the Engineer, the fabric shall not be placed unless the riprap or other material can be used to cover it within the same working day.

When riprap is to be placed on the fabric, stones shall not be dropped from a height greater than the following:

- A. For stones up to 100 pounds in weight, the drop shall not be more than 3 feet.
- B. For stones between 100 and 500 pounds in weight, the drop shall not be more than 1 foot.
- C. For stones over 500 pounds in weight; the stone shall be placed on the cloth, not dropped.
- D. Pushing or rolling rocks over the fabric will not be allowed.

TABLE 1. REQUIREMENTS FOR WOVEN GEOTEXTILES

Property	Test Method	Class I	Class II & III	Class IV
Tensile Strength (pounds) <u>1/</u>	ASTM D 4632 Grab Test	200 minimum in principal direction	120 minimum in any principal direction	180 min. in any principal direction
Elongation at Failure (percent) <u>1/</u>	ASTM D 4632 Grab Test	<50	<50	<50
Puncture (pounds) <u>1/</u>	ASTM D 4833	90 minimum	60 minimum	60 minimum
Ultraviolet Light (percent residual tensile strength)	ASTM D 4355 150-hours exposure	70 minimum	70 minimum	70 minimum
Apparent Opening Size – (AOS)	ASTM D 4751	As specified or a minimum-#70 <u>2/</u>	As specified or a minimum #70 <u>2/</u>	As specified or minimum #70 <u>2/</u>
Percent Open Area <u>3/</u> (percent)	TM5-818-8 <u>4/</u>	4.0 minimum	4.0 minimum	1.0 minimum
Permittivity sec <sup>-1</sup>	ASTM D 4491	0.10 minimum	0.10 minimum	0.10 minimum

1/ Minimum average roll value (weakest principal direction).

2/ U. S. Standard Sieve Size.

3/ If Percent Open Area information is not available, the geotextile should be rated for filtration. Consult the manufacturer for the soils that the fabric is rated for.

4/ NOTE: TM5-818-8 is an Army Technical Manual

TABLE 2. REQUIREMENTS FOR NON-WOVEN GEOTEXTILES

Property	Test Method	Class I	Class II	Class III	Class IV <u>3/</u>
Tensile Strength (pounds) <u>1/</u>	ASTM D 4632 Grab Test	180 minimum	120 minimum	90 minimum	115 min.
Elongation at Failure (percent) <u>1/</u>	ASTM D 4632	≥50	≥50	≥50	≥50
Puncture (pounds)	ASTM D 4833	80 minimum	60 minimum	40 minimum	40 minimum
Ultraviolet Light (percent residual tensile strength)	ASTM D 4355 150-hours exposure	70 minimum	70 minimum	70 minimum	70 minimum
Apparent Opening Size – (AOS)	ASTM D 4751	As specified max. # 40 <u>2/</u>			
Permittivity sec <sup>-1</sup>	ASTM D 4491	0.70 minimum	0.70 minimum	0.70 minimum	0.10 min.

1/ Minimum average roll value (weakest principal direction)

2/ U. S. Standard Sieve Size.

3/ Heat-bonded or resin-bonded geotextile may be used for Class III and IV. They are particularly well suited for Class IV. Needle-punched geotextiles are required for all other classes.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**906 - POST AND WIRE REVETMENT**

**I. SCOPE**

The work shall consist of furnishing and installing post and wire revetment as shown on the drawings, or as staked in the field.

**II. MATERIALS**

Woven wire fabric shall be galvanized Industrial Type 2"x4" "V" mesh 12½ gage 2-ply horizontal wires with 14 gage diagonal wires.

Splicing ties shall be a minimum 10 gage galvanized soft iron wire.

Pipe shall be black steel pipe, Galvanized steel pipe, or used boiler tubing in good condition or equal. The minimum diameter shall be 2½ inches and have a minimum weight of 5¼ pounds per foot of length. The length of each pipe post shall be as shown on the drawings.

Rails shall be new or used railroad rails and shall be sound and straight. Minimum weight and length of rails shall be as shown on the drawings.

Cable shall be minimum of 1/2 inch diameter woven galvanized wire rope. Cable clamps and other fittings shall be standard grade and galvanized.

Rock shall be hard and durable, and shall be greater than 3 inches but less than 10 inches in size.

Grout shall be Portland cement mix with 5½ sacks per cubic yard unless otherwise specified in the "Practice Requirements" sheet. Aggregate shall be clean, durable, well graded sand-gravel mixture with maximum size not to exceed 3/4 inch.

**III. SUBGRADE PREPARATION**

The necessary excavation for placing the bottom of the fencing shall be done to the minimum limits required to properly fasten the fencing to the post. The required excavation shall be backfilled to the grade of the channel bottom after the revetment is installed to density of in-place material.

**IV. INSTALLATION**

The pipe, lateral braces, groins, and tieback supports shall be installed to the configuration, depths, and spacing as shown on the drawings. The posts can be either driven to the specified depths or can be placed in drilled holes with cement grout backfill. Drilled holes shall be six inches greater in diameter than the pipe. The grout shall be allowed to set up for 24 hours before completing the pipe structure. The posts shall be set in a true alignment as shown with no post being out-of-alignment by more than 2-inches, and the top shall be on-line of a uniform grade through the reach.

The top-rails and braces shall be welded to the pipe or rail posts.

The woven wire fabric shall be stretched tight and attached to the end post by lapping the fabric around the post and tying the fabric horizontal wires back onto the same wire. The fabric shall be attached to the top rail and line posts by tying with a double wrap of tie wire. These ties are to be spaced on 12-inch centers.

When fabric needs to be joined, an overlap of 12 inches shall be made and both ends of the fabric horizontal wires tied and wrapped onto the others and twisted a minimum of 5 times. Any laps in the vertical direction shall be a minimum of 4 inches and ties made on each at 12-inch centers.

All cuts of rail or pipe shall be ground to a remove all sharp surfaces. When cables are to be installed, they shall be pulled to the proper tension and securely fastened by clamps.

**V. VEGETATIVE COVER**

Unless otherwise specified in the "Practice Requirements" sheet., a protective cover of vegetation shall be established on the disturbed area. The planting of vegetative materials shall conform to the requirements of Practice Specification 342, Critical Area Planting.

## **VI. SPECIAL MEASURES**

Measures and construction methods shall be incorporated as needed and practical that enhances fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food and den trees.

## **VII. CONSTRUCTION OPERATIONS**

Construction operations shall be done in such a manner that erosion and air and water pollution are minimized and held within legal limits. The owner, operator, Contractor or other persons will conduct all work and operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

The completed job shall be workmanlike and present a good appearance.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**907 - ROCK RIPRAP**

**I. SCOPE**

The work shall consist of furnishing and installing loose rock riprap at the locations and to the lines, grades, elevations, and cross-sections as shown on the drawings.

**II. MATERIALS**

**Rock**

Rock shall be sound, dense, and durable with a bulk specific gravity of not less than 2.5. Rock shall be angular to subrounded in shape with the greatest dimension not greater than 2 times the least dimension. The rock shall conform to the grading limits given below unless otherwise specified on the Practice Requirements sheet.

<u>Size, Inches</u>	<u>Percent Passing</u>
24	100
12	50
6	20
3	10

**Filter or Bedding**

When filter or bedding material is shown on the drawings, the material shall be composed of clean, hard and durable mineral particles free from organic matter, clay balls or other deleterious substances.

Bedding may be pit run material of sand, gravel, crushed stone or a mixture thereof.

Filter material shall conform to the gradation given in the Special Requirements listed on the "Practice Requirements" sheet.

**III. SUBGRADE PREPARATION**

The subgrade surfaces on which the riprap, bedding, filter, or geotextile is to be placed shall be cleared and graded prior to placement of bedding, geotextile, or rock.

When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of appropriate sections of Conservation Construction Specification 903, Earthfill.

**IV. PLACEMENT**

**Equipment Placed Rock Riprap**

The riprap shall be constructed to the full course thickness in one operation and in such a manner as to avoid displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to the permanent works and to achieve the finished surface placement.

**Hand Placed Riprap**

Rocks shall be securely bedded firmly in contact one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a for substitute larger rock. Flat slab rock shall be laid on edge.

**Filter Layers or Bedding**

When specified, the filter, bedding, or geotextile beneath the rock shall be placed on the prepared subgrade as specified in the Special Requirements listed on the "Practice Requirements" sheet. Compaction of filter layers or bedding will not be required, but the surface of such material shall be finished reasonably free of mounds, dips, or windrows.

## **V. VEGETATIVE COVER**

Unless otherwise specified in the “Practice Requirements” sheet, a protective cover of vegetation shall be established on the area disturbed area. The planting of vegetative materials shall conform to the requirements of Practice Specification 342, Critical Area Planting.

## **VI. SPECIAL MEASURES**

Measures and construction methods shall be incorporated as needed and practical that enhances fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food and den trees.

## **VII. CONSTRUCTION OPERATIONS**

Construction operations shall be done in such a manner that erosion and air and water pollution are minimized and held within legal limits. The owner, operator, Contractor or other persons will conduct all work and operations in accordance with proper safety codes for the type of construction being performed with due regards to the safety of all persons and property.

The completed job shall be workmanlike and present a good appearance.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

## 908 – GROUTED ROCK RIPRAP

### I. SCOPE

The work shall consist of furnishing and placing grouted rock at the locations and to the, dimensions lines, grades, and cross sections as shown on the drawings.

### II. MATERIALS

#### Rock

Rock shall be sound, dense and durable with a bulk specific gravity of not less than 2.5. Rock shall be angular to subrounded in shape with greatest dimension not greater than two times the least dimension. The rock shall conform to the grading limits given below unless otherwise specified:

<u>Size, Inches</u>	<u>Percent Passing</u>
24	100
12	50
6	20
3	0

#### Concrete for Grout

The grout shall consist of Portland cement, fine and coarse aggregate, water and an air entraining agent. The cement content shall be 5 1/2 sacks per cubic yard unless otherwise specified in the "Practice Requirements" sheet. Aggregate may be of pit run material provided it is reasonably well graded, clean, durable, and sufficiently free of undesirable substances. Aggregate is adequately graded when not less than 1/3 and not more than 1/2 of the total weight passes through a standard 1/4 inch screen. Clay lumps and organic matter are not to exceed 3 percent of the total weight. Maximum size aggregate will not be greater than 3/4 inches.

#### Filter or Bedding

When filter or bedding material is shown on the drawings, the material shall be of clean, hard and durable mineral particles free from organic matter, clay balls, or other deleterious substances.

Bedding may be pit run material of sand, gravel, crushed stone, or a mixture thereof. It shall be composed of clean, hard durable mineral particles free from organic matter, clay balls, or other deleterious substances.

Filter material shall conform to the gradation given in the Special Requirements listed on the "Practice Requirements" sheet.

### III. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding course is to be placed shall be cleared and graded prior to placement of bedding or rock. When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of appropriate sections of Conservation Construction Specification 903, Earthfill.

### IV. PLACEMENT OF ROCK

Filters and bedding, when required shall be spread uniformly on the prepared subgrade to the depths shown on the drawings.

The rock shall be placed to the depths specified in such a manner as to avoid displacement of the underlying materials. The rock may be equipment or hand placed as necessary to produce a surface in which the tops of the individual rocks do not vary more than 6 inches from the neat lines.

### V. PLACING GROUT

The rock shall be washed with water to remove the fines from the rock prior to placing the grout. The rock shall be kept moist before the grouting and without placing in standing or flowing water.

The rock shall be washed with water to remove the fines from the rock prior to placing the grout. The rock shall be kept moist before the grouting and without placing in standing or flowing water. Grout placed on

inverts or other nearly level areas may be placed in one operation. On slopes, the grout shall be placed in lateral strips approximately ten (10) feet in width starting at the toe of the slope and progressing to the top. The grout shall be delivered to the place of final deposit by approved means and discharged directly on the surface of the rock, using a splash plate of metal or wood to prevent displacement of the rock directly under the discharge. The flow of the grout shall be directed with brooms, spades or baffles to prevent it from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be done to loosen tight pockets of rock and otherwise aid in the penetration of grout so that all voids shall be filled and the grout fully penetrate the lower 2/3 of the rock blanket. All brooming on slopes shall be uphill and after the grout has stiffened, the entire surface shall be rebroomed to eliminate runs and to fill voids caused by sloughing. The surface finish, following the completion of grout installation, shall consist of one-third of the rock extended above the level of grout. The exposed rock will not have a plastered appearance

After completion of any strip or panel, no workman or other load shall be permitted on the grouted surface for a period of 24 hours.

## **VI. PROTECTION**

Do not place grouted rock in freezing weather. The grouted surface shall be protected from injurious action by the sun, rain, flowing water, and/or mechanical injury. The grouted rock shall be prevented from drying for a curing period of at least 7 days after it is placed.

In lieu of water curing, the grouted rock shall be cured by spraying with an approved curing compound. The curing compound shall be applied in an approved manner as soon as practicable after the concrete is finished. All surfaces shall be kept moist until the compound is applied.

## **VII. VEGETATIVE COVER**

Unless otherwise specified a protective cover of vegetation shall be established on the disturbed area. The planting of vegetative materials shall conform to the requirements of Conservation Practice Specification 342, Critical Area Planting.

## **VIII. SPECIAL MEASURES**

Measures and construction methods shall be incorporated as needed and practical that enhances fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food and den trees.

## **IX. CONSTRUCTION OPERATIONS**

Construction operations shall be done in such a manner that erosion and air and water pollution are minimized and held within legal limits. The owner, operator, Contractor or other persons will conduct all work and operations in accordance with proper safety codes for the type of construction being performed with regards to the safety of all persons and property.

The completed job shall be workmanlike and present a good appearance.

NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION CONSTRUCTION SPECIFICATION

**909 - CONTROL OF WATER**

**I. SCOPE**

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the specifications. It shall include (1) building and maintaining all necessary temporary impounding works, channels, and diversions, (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment, and (3) removing all such temporary works and equipment after they have served their purposes. All work shall be done in a manner approved by the engineer.

**II. DIVERTING SURFACE WATER**

The Contractor shall build, maintain and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainage way in which its headworks are located.

**III. DEWATERING THE CONSTRUCTION SITE**

Foundation cutoff trenches and other parts of the construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps, casings, well-points, and other equipment needed to perform the dewatering as specified.

Dewatering methods that cause a loss of fines from the foundation areas will not be permitted.

**IV. DEWATERING BORROW AREA**

Unless otherwise specified in the "Practice Requirements" sheet, Contractor shall maintain the borrow areas free of surface water or otherwise provide for timely and effective removal of surface waters that accumulate within the borrow areas from any source.

Borrow material shall be processed as necessary to achieve proper and uniform moisture content for placement.

If pumping to dewater area is included as an item of work in the bid schedule, each pump used for this purpose shall be equipped with a water meter in the discharge line. Accuracy of the meters shall be such that the measured quantity of water is within 3 percent, plus or minus, of the true quantity.

Means shall be provided by the Contractor to check the accuracy of the water meters when requested by the engineer.

**V. REMOVAL OF TEMPORARY WORKS**

After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a slightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

Except as otherwise specified in the "Practice Requirements" sheet, pipes and casings shall be removed from temporary wells and the wells shall be filled to ground level with gravel or other material approved by the engineer.

**VI. EROSION AND POLLUTION CONTROL**

Removal of water from the construction site, including the borrow areas, shall be accomplished in a manner that erosion and the transporting of sediment and other pollutants are minimized. Dewatering activities shall be accomplished in a manner that the water table water quality is not altered.

**VII. SPECIAL MEASURES**

Measures and construction methods shall be incorporated as needed and practical that enhances fish and wildlife values. Special attention shall be given to protecting visual resources and maintaining key shade, food, and den trees.