M/037/088

Water Resources

Environmental Studies

HYDRO-TRIAD, LTD
12136 W. Bayaud Ave., Suite 100
Lakewood, Colorado 80228
Phone: 303/989-8588, Fax: 303/989-9932

TO: Tom Munson
Div. Oil, Gas & Mining
Fax # (801) 359-3940

DATE: 18 December 96

PROJECT: Lisbon Valley

ATTN:

DESCRIPTION/REMARKS Review & Comment

1) Appendices will follow in separate transmittal

2) I will wait for your comments before sending out the final

Appendices Attached

APPENDIX B

Batch 2

Number of pages Including Cover Sheet: 12
Any problems receiving, please call: 303/989-8588
Return FAX Number: 303/989-9932

By: Thompson
HTL

Copy To:

The document(s) with this transmission are only for recipient(s) named above and contain privileged/confidential information. Unauthorized disclosure, dissemination and/or copying of this transmission is strictly prohibited. If received in error, please destroy and notify the sender by calling collect.

Appendix B

HYDRO-TRIAD, LTD.
CALCULATION SHEET

By: TB Date: 12/16/96 Subject: Rip-Rap Calculations Job No.: 475-001
Checked: TB Date: 12/18/96 Lee's Ranch Sheet No. 1 of 3

Equation 5-4
Urban Drainage Criteria manual

$$d_{50} = \left(\frac{V S^{0.17}}{(S_s - 1)^{0.66}\, 45} \right)^2$$

V → Mean Velocity (fps)
S – Slope (Feet/Feet)
S_s – Specific gravity of rock
d_{50} – Rock size in feet for which 50% of the riprap by weight is smaller

Design Point #3

* $V_{max} = 7.0$ (fps)
$S = 0.05$

$$d_{50} = \left(\frac{(7.0)(0.05)^{0.17}}{(2.5-1)^{0.66}\,(45)} \right)^2 = 0.5'$$

$$\frac{VS^{0.17}}{(S_s-1)^{0.66}} = \frac{(7.0)(0.05)^{0.17}}{(2.5-1)^{0.66}} = 3.2 \ \frac{ft^{1/2}}{s}$$

Rock Type = VL

Design Point #4

* $V_{max} = 6.9$ fps
$S = 0.045$

$$d_{50} = \left(\frac{(6.9)(0.045)^{0.17}}{(2.5-1)^{0.66}\,4.5} \right)^2 = 0.5'$$

$$\frac{VS^{0.17}}{(S_s-1)^{0.66}} = \frac{(6.9)(0.045)^{0.17}}{(2.5-1)^{0.66}} = 3.1 \ \frac{ft^{1/2}}{s}$$

Rock Type = VL

Design Point #8

$V_{max} = 5.7$ fps
$S = 0.006$

$$d_{50} = \left(\frac{(5.7)(0.006)^{0.17}}{(2.5-1)^{0.66}\,(4.5)} \right)^2 = 0.16'$$

$$\frac{VS^{0.17}}{(S-1)^{0.66}} = \frac{(5.7)(0.006)^{0.17}}{(2.5-1)^{0.66}} = 1.8$$

Rock Type = VL

* Riprap sections of each channel will have reduced slopes of 5% (Design Point 3) and 4.5% (Design Point 4).

Revisions: ____ Date: ____
By: ____

HYDRO-TRIAD, LTD.
CALCULATION SHEET

By: TP Date: 12/16/96 Subject: Riprap Calculations Job No.: LTS-001

Checked: _____ Date: _____ Lisbon Valley Sheet No. 2 of 3

Revisions: _____ By: _____ Date: _____

Design Point #10

$V_{max} = 6.5$ fps

$S = 0.005$

$$d_{50} = \left(\frac{(6.5)(0.005)^{0.17}}{(2.5-1)^{0.66}(4.5)}\right)^2 = 0.20'$$

$$\frac{VS^{0.17}}{(S-1)^{0.66}} = \frac{(6.5)(0.005)^{0.17}}{(2.5-1)^{0.66}} = 2.0$$

Rock Type = VL

Design Point #11

$V_{max} = 5.9$

$S = 0.006$

$$d_{50} = \left(\frac{(5.9)(0.006)^{0.17}}{(2.5-1)^{0.66}(4.5)}\right)^2 = 0.17'$$

$$\frac{VS^{0.17}}{(S-1)^{0.66}} = \frac{(5.9)(0.006)^{0.17}}{(2.5-1)^{0.66}} = 1.9$$

Rock Type = VL

Design Point #13

$V_{max} = 5.6$

$S = 0.006$

$$d_{50} = \left(\frac{(5.6)(0.006)^{0.17}}{(2.5-1)^{0.66}(4.5)}\right)^2 = 0.16'$$

$$\frac{VS^{0.17}}{(S-1)^{0.66}} = \frac{(5.6)(0.006)^{0.17}}{(2.5-1)^{0.66}} = 1.8$$

Rock Type = VL

Design Point #14

$V_{max} = 6.3$

$S = 0.005$

$$d_{50} = \left(\frac{(6.3)(0.005)^{0.17}}{(2.5-1)^{0.66}(4.5)}\right)^2 = 0.19'$$

$$\frac{VS^{0.17}}{(S-1)^{0.66}} = \frac{(6.3)(0.005)^{0.17}}{(2.5-1)^{0.66}} = 2.0$$

Rock Type = VL

HYDRO-TRIAD, LTD.
CALCULATION SHEET

By: TB Date: 12/17/96 Subject: Riprap Calculations Job No.: 475-001
Checked: ____ Date: ____ Lisbon Valley Sheet No. 3 of 3

Revisions: ____ Date: ____
By: ____

Design Point #15

$V_{max} = 8.2$ fps
$S = 0.005$

$$\frac{VS^{0.17}}{(S_s-1)^{0.66}} = \frac{(8.2)(0.005)^{0.17}}{(2.5-1)^{0.66}} = 2.5$$

$$d_{50} = \left(\frac{(8.2)(0.005)^{0.17}}{(2.5-1)^{0.66}(4.5)}\right)^2 = 0.32'$$

Rock Type = VL

Design Point #16

$V_{max} = 8.6$
$S = 0.005$

$$\frac{VS^{0.17}}{(S_s-1)^{0.66}} = \frac{(8.6)(0.005)^{0.17}}{(2.5-1)^{0.66}} = 2.7$$

$$d_{50} = \left(\frac{(8.6)(0.005)^{0.17}}{(2.5-1)^{0.66}(4.5)}\right)^2 = 0.35'$$

Rock Type = VL