NEVADA TAHOE CONSERVATION DISTRICT

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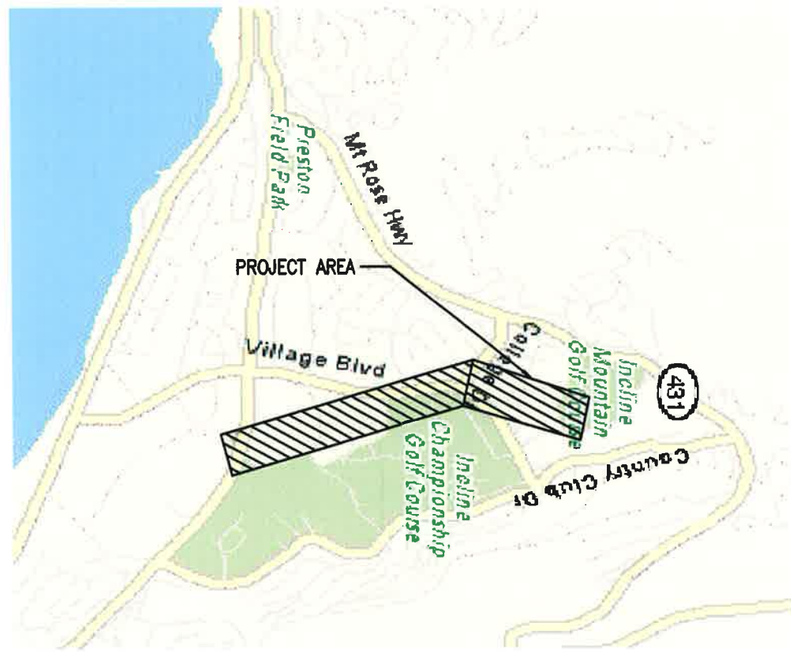
MIDDLE ROSEWOOD CREEK SEZ RESTORATION

IN THE COUNTY OF WASHOE

VICINITY MAP

COUNTY OF WASHOE



PROJECT AREA MAP

INCLINE VILLAGE

IMPLEMENTATION AREA INDEX

Implementation Area	Downstream Station	Upstream Station	Reach(es)*
A	0+00	19+40	1 to 6
B	20+00	22+50	6
C	26+00	32+75	7 to 10
D	32+75	36+40	10 and 11
E	42+25	43+25	13
F	43+25	49+75	13
G	51+00	58+50	14
H	58+50	64+25	15
I	64+75	69+00	16

* Mainstream (2005)

CONCEPT PLAN
APRIL 2006

ENGINEER:

ENGINEER: STEPHEN H. PECK, P.E.
REGISTERED CIVIL ENGINEER
STATE OF NEVADA, NO. 16993

DATE

REVISIONS			
MARK	DATE	BY	

Nevada Tahoe Conservation District

ENTRIX

Valley & Mountain Consulting

WOOD RODGERS

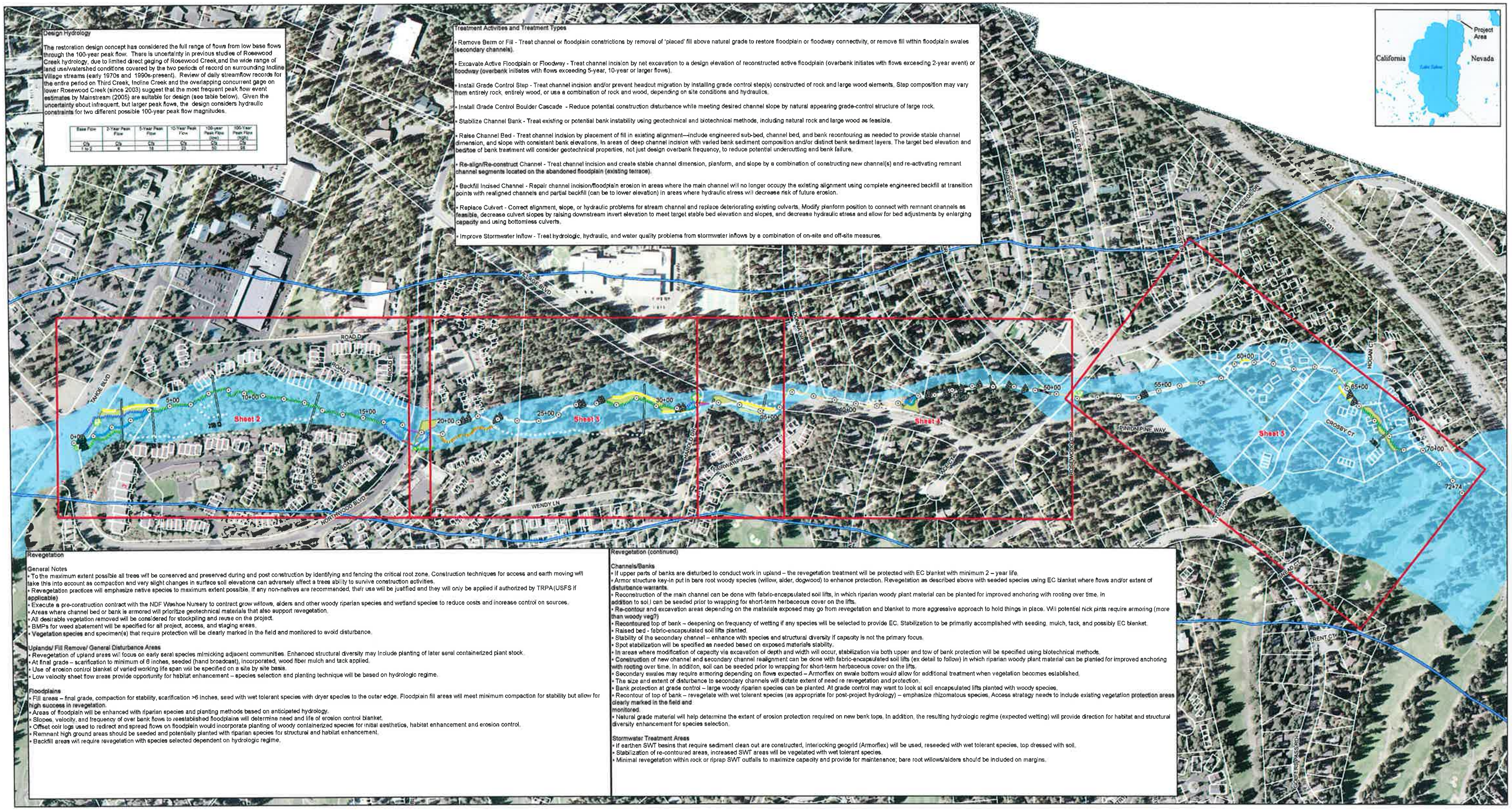
MIDDLE ROSEWOOD CREEK SEZ RESTORATION

CONCEPT PLAN

TITLE SHEET

Sheet i

DATE
Apr 05, 2006



Design Hydrology

The restoration design concept has considered the full range of flows from low base flows through the 100-year peak flow. There is uncertainty in previous studies of Rosewood Creek hydrology, due to limited direct gaging of Rosewood Creek,and the wide range of land use/watershed conditions covered by the two periods of record on surrounding Incline Village streams (early 1970s and 1990s-present). Review of daily streamflow records for the entire period on Third Creek, Incline Creek and the overlapping concurrent gage on lower Rosewood Creek (since 2003) suggest that the most frequent peak flow event estimates by Mainstream (2005) are suitable for design (see table below). Given the uncertainty about infrequent, but larger peak flows, the design considers hydraulic constraints for two different possible 100-year peak flow magnitudes.

Base Flow	2-Year Peak Flow	5-Year Peak Flow	10-Year Peak Flow	100-year Peak Flow (low)	100-Year Peak Flow (high)
Cfs	Cfs	Cfs	Cfs	Cfs	Cfs
1 to 2	9	18	23	50	98

Treatment Activities and Treatment Types

- Remove Berm or Fill - Treat channel or floodplain constrictions by removal of 'placed' fill above natural grade to restore floodplain or floodway connectivity, or remove fill within floodplain swales (secondary channels).
- Excavate Active Floodplain or Floodway - Treat channel incision by net excavation to a design elevation of reconstructed active floodplain (overbank initiates with flows exceeding 2-year event) or floodway (overbank initiates with flows exceeding 5-year, 10-year or larger flows).
- Install Grade Control Step - Treat channel incision and/or prevent headcut migration by installing grade control step(s) constructed of rock and large wood elements. Step composition may vary from entirely rock, entirely wood, or use a combination of rock and wood, depending on site conditions and hydraulics.
- Install Grade Control Boulder Cascade - Reduce potential construction disturbance while meeting desired channel slope by natural appearing grade-control structure of large rock.
- Stabilize Channel Bank - Treat existing or potential bank instability using geotechnical and biotechnical methods, including natural rock and large wood as feasible.
- Raise Channel Bed - Treat channel incision by placement of fill in existing alignment—include engineered sub-bed, channel bed, and bank recontouring as needed to provide stable channel dimension, and slope with consistent bank elevations. In areas of deep channel incision with varied bank sediment composition and/or distinct bank sediment layers. The target bed elevation and bed/toe of bank treatment will consider geotechnical properties, not just design overbank frequency, to reduce potential undercutting and bank failure.
- Re-align/Re-construct Channel - Treat channel incision and create stable channel dimension, planform, and slope by a combination of constructing new channel(s) and re-activating remnant channel segments located on the abandoned floodplain (existing terrace).
- Backfill Incised Channel - Repair channel incision/floodplain erosion in areas where the main channel will no longer occupy the existing alignment using complete engineered backfill at transition points with realigned channels and partial backfill (can be to lower elevation) in areas where hydraulic stress will decrease risk of future erosion.
- Replace Culvert - Correct alignment, slope, or hydraulic problems for stream channel and replace deteriorating existing culverts. Modify planform position to connect with remnant channels as feasible, decrease culvert slopes by raising downstream invert elevation to meet target stable bed elevation and slopes, and decrease hydraulic stress and allow for bed adjustments by enlarging capacity and using bottomless culverts.
- Improve Stormwater Inflow - Treat hydrologic, hydraulic, and water quality problems from stormwater inflows by a combination of on-site and off-site measures.

Revegetation

General Notes
- To the maximum extent possible all trees will be conserved and preserved during and post construction by identifying and fencing the critical root zone. Construction techniques for access and earth moving will take this into account as compaction and very slight changes in surface soil elevations can adversely affect a trees ability to survive construction activities.
- Revegetation practices will emphasize native species to maximum extent possible. If any non-natives are recommended, their use will be justified and they will only be applied if authorized by TRPA(USFS if applicable)
- Execute a pre-construction contract with the NDF Washoe Nursery to contract grow willows, alders and other woody riparian species and wetland species to reduce costs and increase control on sources.
- Areas where channel bed or bank is armored will prioritize geotechnical materials that also support revegetation.
- All desirable vegetation removed will be considered for stockpiling and reuse on the project.
- BMPs for weed abatement will be specified for all project, access, and staging areas.
- Vegetation species and specimen(s) that require protection will be clearly marked in the field and monitored to avoid disturbance.

Uplands/ Fill Remove/ General Disturbance Areas
- Revegetation of upland areas will focus on early seral species mimicking adjacent communities. Enhanced structural diversity may include planting of later seral containerized plant stock.
- At final grade – scarification to minimum of 6 inches, seeded (hand broadcast), incorporated, wood fiber mulch and tack applied.
- Use of erosion control blanket of varied working life span will be specified on a site by site basis.
- Low velocity sheet flow areas provide opportunity for habitat enhancement – species selection and planting technique will be based on hydrologic regime.

Floodplains
- Fill areas – final grade, compaction for stability, scarification >6 inches, seed with wet tolerant species with dryer species to the outer edge. Floodplain fill areas will meet minimum compaction for stability but allow for high success in revegetation.
- Areas of floodplain will be enhanced with riparian species and planting methods based on anticipated hydrology.
- Slopes, velocity, and frequency of over bank flows to reestablished floodplains will determine need and life of erosion control blanket.
- Offset coir logs used to redirect and spread flows on floodplain would incorporate planting of woody containerized species for initial aesthetics, habitat enhancement and erosion control.
- Remnant high ground areas should be seeded and potentially planted with riparian species for structural and habitat enhancement.
- Backfill areas will require revegetation with species selected dependent on hydrologic regime.

Revegetation (continued)

Channels/Banks
- If upper parts of banks are disturbed to conduct work in upland – the revegetation treatment will be protected with EC blanket with minimum 2 – year life.
- Armor structure key-in put in bare root woody species (willow, alder, dogwood) to enhance protection. Revegetation as described above with seeded species using EC blanket where flows and/or extent of disturbance warrants.
- Reconstruction of the main channel can be done with fabric-encapsulated soil lifts, in which riparian woody plant material can be planted for improved anchoring with rooting over time. In addition to soi,l can be seeded prior to wrapping for short-term herbaceous cover on the lifts.
- Re-contour and excavation areas depending on the materials exposed may go from revegetation and blanket to more aggressive approach to hold things in place. Will potential nick pints require armoring (more than woody veg?)
- Recontoured top of bank – deepening on frequency of wetting if any species will be selected to provide EC. Stabilization to be primarily accomplished with seeding, mulch, tack, and possibly EC blanket.
- Raised bed - fabric-encapsulated soil lifts planted.
- Stability of the secondary channel – enhance with species and structural diversity if capacity is not the primary focus.
- Spot stabilization will be specified as needed based on exposed materials stability.
- In areas where modification of capacity via excavation of depth and width will occur, stabilization via both upper and tow of bank protection will be specified using biotechnical methods.
- Construction of new channel and secondary channel realignment can be done with fabric-encapsulated soil lifts (ex detail to follow) in which riparian woody plant material can be planted for improved anchoring with rooting over time. In addition, soil can be seeded prior to wrapping for short-term herbaceous cover on the lifts.
- Secondary swales may require armoring depending on flows expected – Armorflex on swale bottom would allow for additional treatment when vegetation becomes established.
- The size and extent of disturbance to secondary channels will dictate extent of need re revegetation and protection.
- Bank protection at grade control – large woody riparian species can be planted. At grade control may want to look at soil encapsulated lifts planted with woody species.
- Recontour of top of bank – revegetate with wet tolerant species (as appropriate for post-project hydrology) – emphasize rhizomatous species. Access strategy needs to include existing vegetation protection areas clearly marked in the field and monitored.
- Natural grade material will help determine the extent of erosion protection required on new bank tops. In addition, the resulting hydrologic regime (expected wetting) will provide direction for habitat and structural diversity enhancement for species selection.

Stormwater Treatment Areas
- If earthen SWT basins that require sediment clean out are constructed, interlocking geogrid (Armorflex) will be used, reseeded with wet tolerant species, top dressed with soil.
- Stabilization of re-contoured areas, increased SWT areas will be vegetated with wet tolerant species.
- Minimal revegetation within rock or riprap SWT outfalls to maximize capacity and provide for maintenance; bare root willows/alders should be included on margins.

Existing Features
- Existing Main Channel
- Existing Secondary Channel
- Culvert
- Berm

Other Features
- 100 Foot River Station
- Representative Cross-Section (See Drawings)
- Reaches (Mainstream 2005)
- Rosewood Ck Watershed
- Parcel Boundary

Proposed Features
- Construct New Main Channel
- Raise Main Channel Bed
- Fill Existing Main Channel
- Backfill Secondary Channel
- Improve Secondary Channel
- Raise Right Bank
- Stabilize Bank
- New Culvert
- Remove Culvert
- Remove Berm
- Grade Control (Boulder Cascade)
- Grade Control
- Stormwater Treatment Area
- Fill Removal / Excavate Floodplain
- Rosewood Creek Watershed
- 1 b SEZ

1 inch equals 200 feet

0 50 100 200
Feet

Nevada Tahoe Conservation District

ENTRIX

Valley & Mountain Consulting, Inc.

Wood Rodgers

Middle Rosewood Creek SEZ Restoration

Concept Plan

Sheet 1

DATE
Apr 26, 2006

Existing Features
- Existing Main Channel
- Existing Secondary Channel
- Culvert
- Berm

Other Features
- 100 Foot River Station
- Parcel Boundary
- Representative Cross-Section (See Drawings)
- Rosewood Creek Watershed

Proposed Features
- Construct New Main Channel
- Raise Main Channel Bed
- Fill Existing Main Channel
- Backfill Secondary Channel
- Improve Secondary Channel
- Raise Right Bank
- Stabilize Bank
- New Culvert
- Remove Culvert
- Grade Control (Boulder Cascade)
- Grade Control
- Remove Berm
- Stormwater Treatment Area
- Fill Removal / Excavate Floodplain

1 inch equals 50 feet

0 50 100 200
Feet

Nevada Tahoe Conservation District

ENTRIX

Valley Mountain Consulting

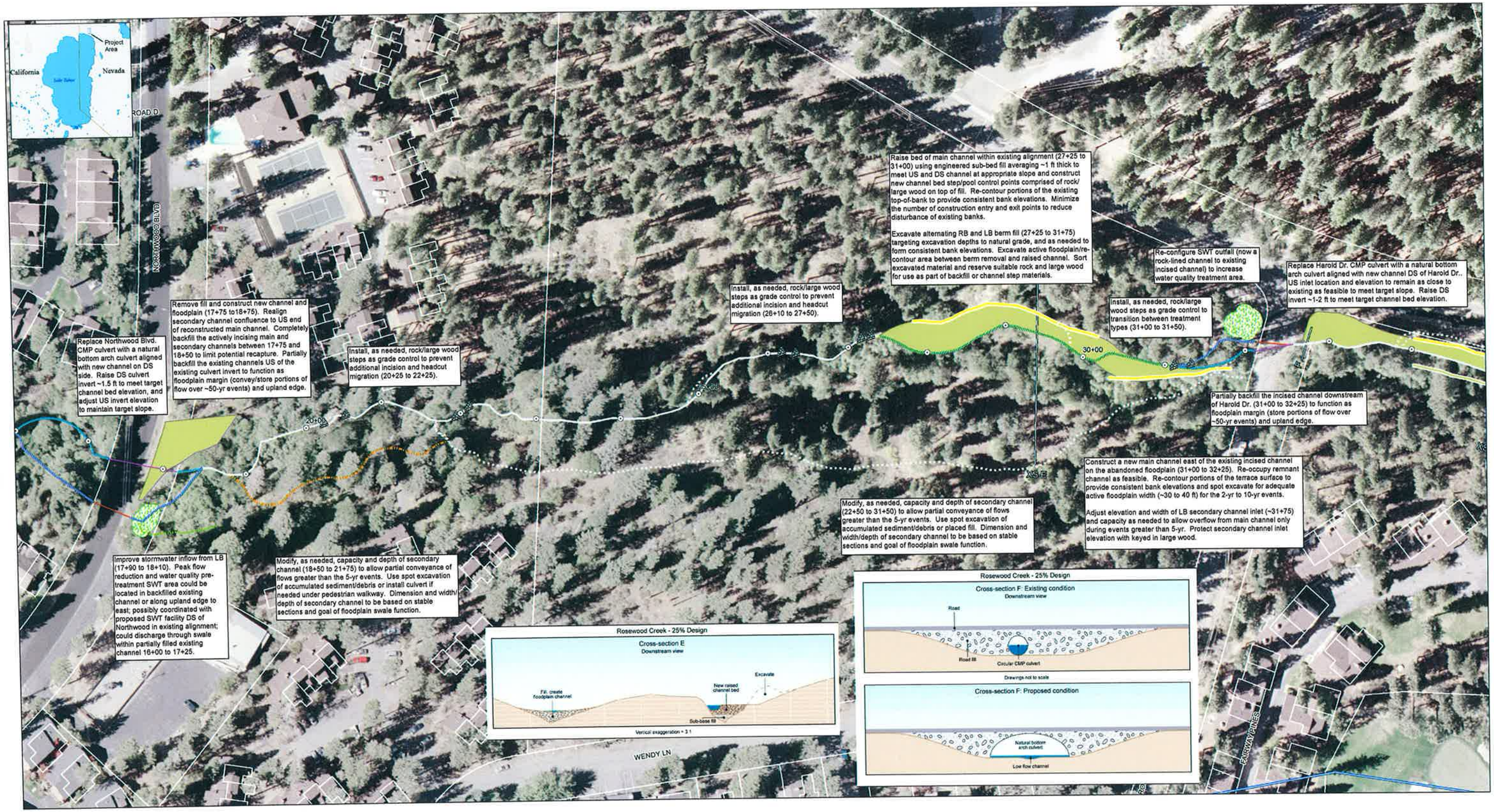
WOOD RODGERS

Middle Rosewood Creek SEZ Restoration

Concept Plan

Sheet 2

DATE
Apr 25, 2006



Existing Features
- Existing Main Channel
- Existing Secondary Channel
- Culvert
- Berm

Other Features
- 100 Foot River Station
- Parcel Boundary
- Representative Cross-Section (See Drawings)
- Rosewood Creek Watershed

Proposed Features
- Construct New Main Channel
- Raise Main Channel Bed
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- Stormwater Treatment Area
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1 inch equals 50 feet

0 50 100 200
Feet

Nevada Tahoe Conservation District

ENTRIX

Valley & Mountain Consulting

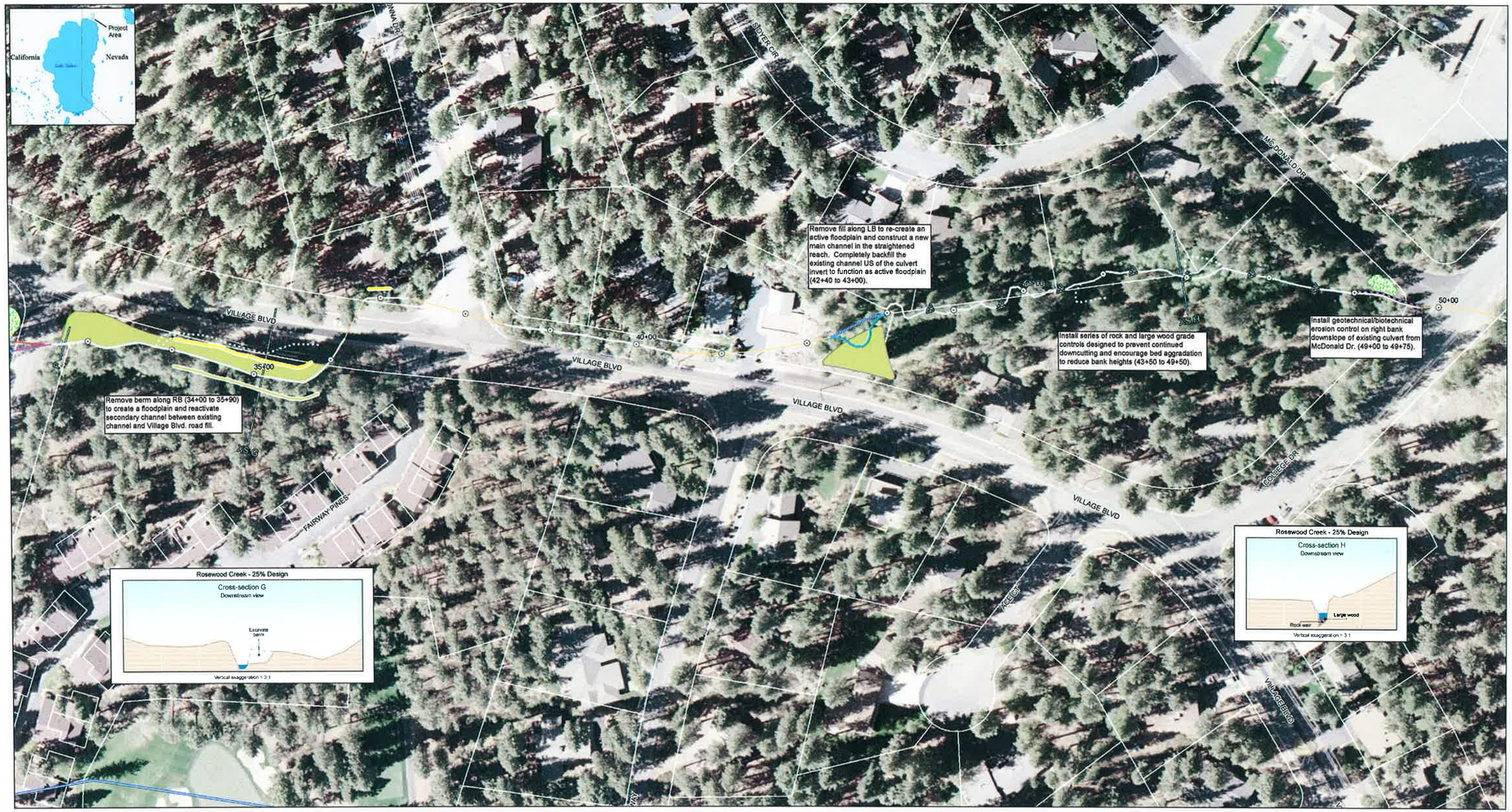
WOOD RODGERS

Middle Rosewood Creek SEZ Restoration

Concept Plan

Sheet 3

DATE
Apr 25, 2006



Existing Features
- Existing Main Channel
- Existing Secondary Channel
- Culvert
- Berm

Other Features
- 100 Foot River Station
- Parcel Boundary
- Representative Cross-Section (See Drawings)
- Rosewood Creek Watershed

Proposed Features
- Construct New Main Channel
- Raise Main Channel Bed
- Fill Existing Main Channel
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- New Culvert
- Remove Culvert
- Grade Control (Boulder Cascade)
- Grade Control
- Remove Berm
- Stormwater Treatment Area
- Fill Removal / Excavate Floodplain

1 inch equals 50 feet

0 50 100 200
Feet

Nevada Tahoe Conservation District

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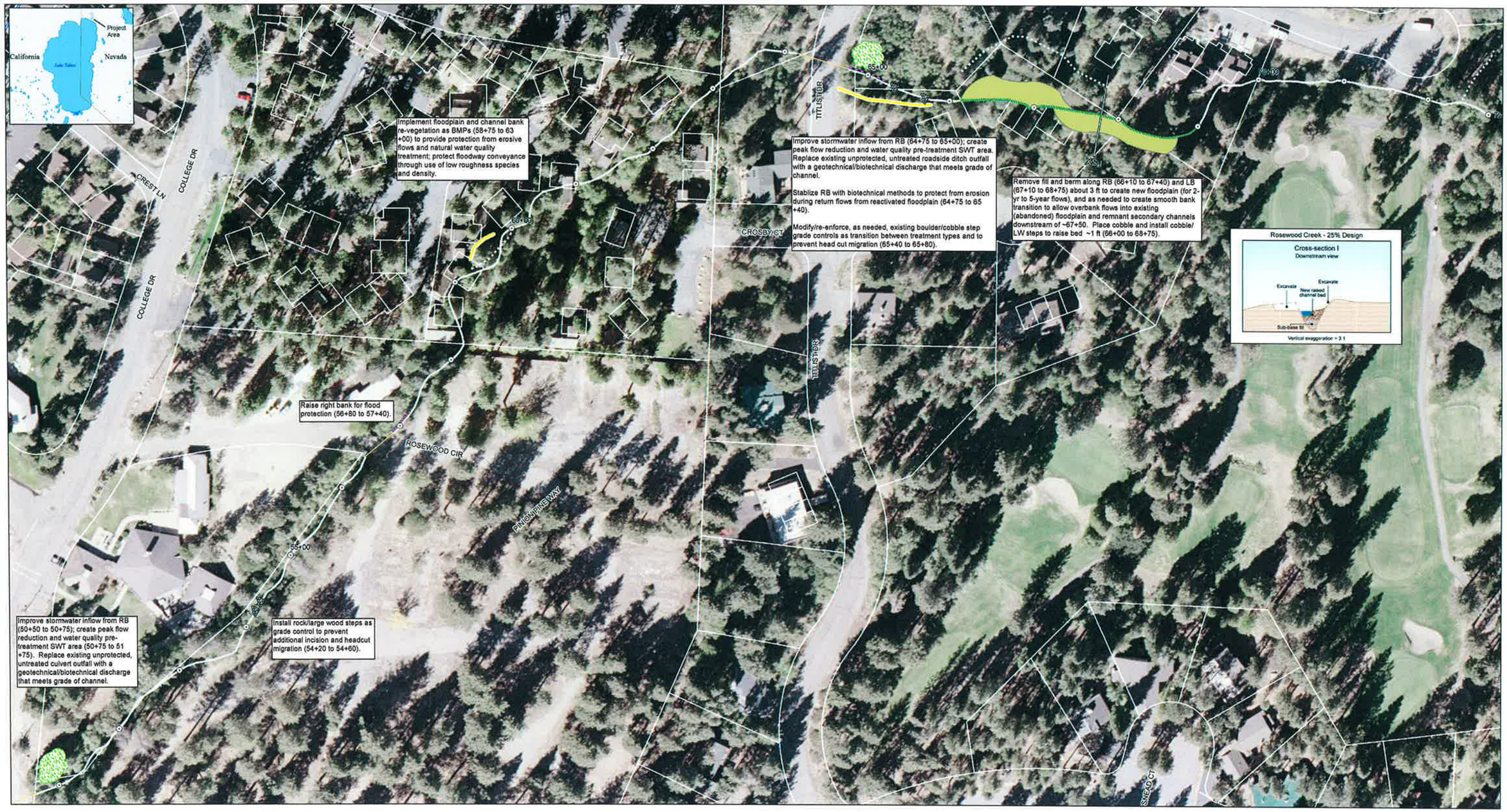
WOOD RODGERS

Middle Rosewood Creek SEZ Restoration

Concept Plan

Sheet 4

DATE
Apr 25, 2006



Existing Features
- Existing Main Channel
- Existing Secondary Channel
- Culvert
- Berm

Other Features
- 100 Foot River Station
- Parcel Boundary
- Representative Cross-Section (See Drawings)
- Rosewood Creek Watershed

Proposed Features
- Construct New Main Channel
- Raise Main Channel Bed
- Fill Existing Main Channel
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- Improve Secondary Channel
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- Stabilize Bank
- New Culvert
- Remove Culvert
- Grade Control (Boulder Cascade)
- Grade Control
- Remove Berm
- Stormwater Treatment Area
- Fill Removal / Excavate Floodplain

1 inch equals 50 feet

0 50 100 200

Feet

Nevada Tahoe Conservation District

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Wood Rodgers

Middle Rosewood Creek SEZ Restoration

Concept Plan

Sheet 5

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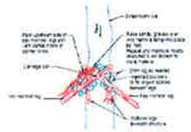
Apr 25, 2006

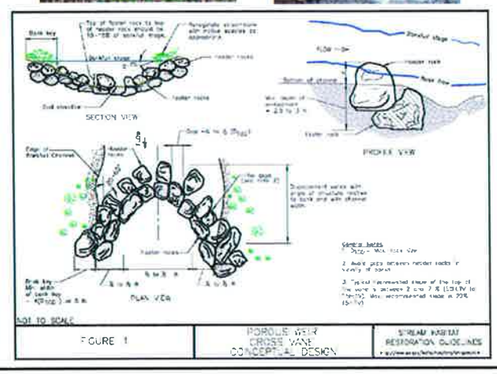
Grade Control



Constructed channel-spanning step composed of large wood and coarse sediment. Designed to halt knickpoint propagation upstream, and if desired, promote sediment trapping to aggrade the bed.

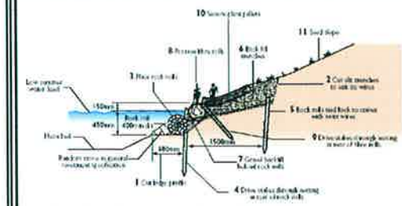
Constructed channel cascade composed of cobble and boulder. Designed to provide channel stability where steep transitions in bed slope are required.

Constructed weir composed primarily of cobble and boulder. Designed to halt knickpoint propagation upstream.



Source: Salik-Carcotile, K., K. Bates, P. Skidmore, J. Barenti, D. Pierce. 2004. Stream Habitat Restoration Guidelines. Final Draft. Co-published by the Washington Departments of Fish and Wildlife and Ecology and the U.S. Fish and Wildlife Service. Olympia, Washington.

Bank Stabilization

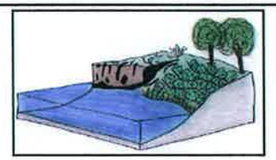


Bank stabilization (with the option for channel narrowing) using primarily bio-engineering methods. Appropriate for streambanks where armoring of the bank is not necessary.

Source: Manual of River Restoration Techniques, RRC – Web Edition, 2002: http://therrc.co.uk

Bank stabilization (with the option for channel narrowing) using large, immobile rock. Appropriate for streambanks that are over-steepened and where armoring of the bank may be necessary to prevent future erosion or protect adjacent infrastructure.

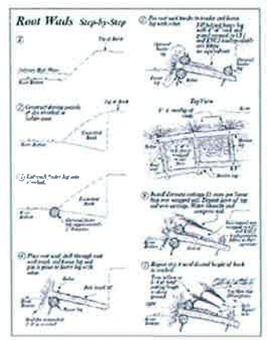
Source: The Rogue River Project: http://www.rougeriver.com



Bank stabilization achieved through excavation of the bank to reduce its steepness and increase streambank conveyance capacity.

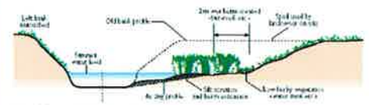
Source: U.S. Army Corps of Engineers. 1998. "Illustrations of Environmental Engineering Features for Planning." Decision Support Technologies Research Program. IWR Report 98-R-8

Bank stabilization (with the option for channel narrowing) using large wood with root wads intact and backfill with revegetation. Appropriate for locations where construction of a streambank resembling a natural condition is desired.



Source: Alaska Dept. of Fish & Game: http://www.sf.adfg.state.ak.us

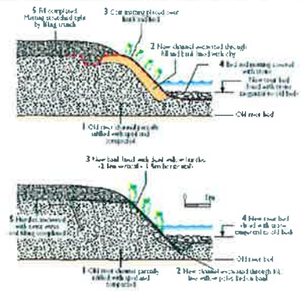
Floodplain Construction



Source: Manual of River Restoration Techniques, RRC – Web Edition, 2002: http://therrc.co.uk

Excavation of the over-steepened bank along the incised channel to create a new floodplain that is inundated more frequently. Revegetation species and excavation width and depth vary depending upon location.

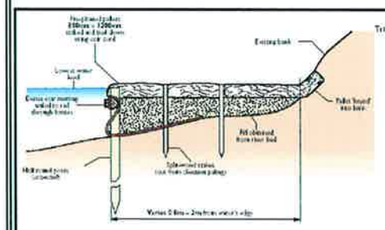
Raise Channel Bed and Construct New Bank



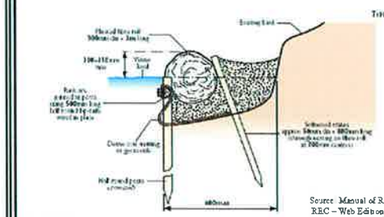
Source: Manual of River Restoration Techniques, RRC – Web Edition, 2002: http://therrc.co.uk

Import fill into the channel to raise the bed elevation and reduce bank erosion and restore a floodplain connection. Type of fill used to construct the new channel bed will vary with location. Illustrations show two different examples of stabilizing new channel banks until new vegetation has matured.

Narrow the Channel



Illustrations depict two methods that could be used to narrow the channel width. Techniques are designed to provide immediate bank stabilization while promoting fine sediment trapping that, combined with compaction of the backfill, will lead to naturalized streambanks over time.



Source: Manual of River Restoration Techniques RRC – Web Edition, 2002 http://therrc.co.uk

*All details and text are 'generic' at this point from the cited references, any key custom, site-specific aspects will be added in the final design drawings.

REVISIONS			
MARK	DATE	BY	

Nevada Tahoe Conservation District

ENTRIX

Valley Mountain Consulting

WOOD RODGERS

MIDDLE ROSEWOOD CREEK SEZ RESTORATION

CONCEPT PLAN

DETAILS

Sheet 6

DATE Apr 05, 2006