

# LOWER SITE PROJECT COMPONENTS PROJECT F AND G:

## Confluence Wetlands and Dead Elk Pond

The design for Dead Elk Pond achieves several environmental and programmatic goals of the concept plan. First, stormwater retention capacity is expanded to accommodate new impervious surface runoff generated in the neighborhood development and streets. Water coming from the development will flow into Dead Elk Pond through a series of three stepped pools, which will slow water down before entering the largest pond and flowing off-site. The extra holding volume of the pond will slow before it leaves the site and enters the Blue River, thus reducing sediment loading downstream. Conversely, when very high volumes are flowing down French Creek from backcountry areas, water can move up the pools for temporary retention.

Second, the dredge rock is recontoured and sculpted into a 'ridge and valley' system, from which micro-climatic habitats will form and evolve. For example, the ridges form dry high-points for commanding and unimpeded views down the valley floor to the Rocky Mountains beyond, while simultaneously screening the lower development and framing views of the expanded pond and wetlands. The north-facing slopes of the

ridges are planted with clusters of tall evergreen trees, emulating the natural system of tree growth in the region, while screening the adjacent down-valley housing developments. The wet, sheltered valley low-points promote wetland plant growth and other vegetation for filtering runoff and groundwater coming from the abandoned mining zones, and regenerating healthy aquatic life.

Dead Elk Pond will be made accessible with paths that run the perimeter of the area, and traverse the sculpted ridge and valley wasterock terrain. A picnic area will be located on a flat terrace near the confluence of French Gulch and Dead Elk Pond. Just upstream from this confluence point a new wetland area will assist in slowing water down before spilling into Dead Elk Pond. The new wetland will be constructed in a way that enhances the 'water experience' as one cross over the future bridge between the housing areas. Crushed gravel pedestrian paths will be constructed along the wetland's edge, linking the street circulation system with the riparian path system using trailhead nodes and landings. The overall design greatly enhances the edge marsh habitat.



Existing Conditions: Lower Site

Future Permeable Reactive Barrier

Activity Green

Trail Head Access

Terrace Overlook

Dredge Rock Ridge/Valley

Picnic Area

Community Center

Bus Stop

G. DEAD ELK POND

Recreational Trail

F. CONFLUENCE WETLANDS



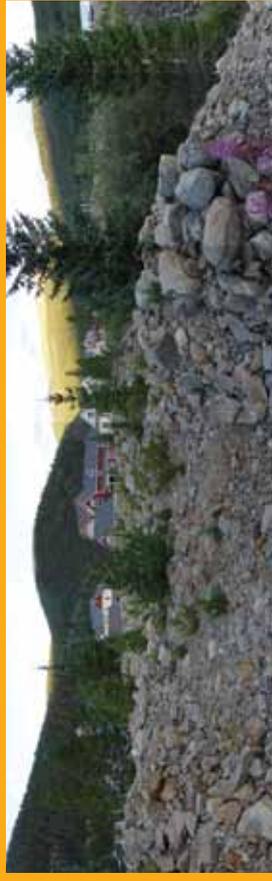
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# PROJECT F:

## Enhanced Confluence Wetlands

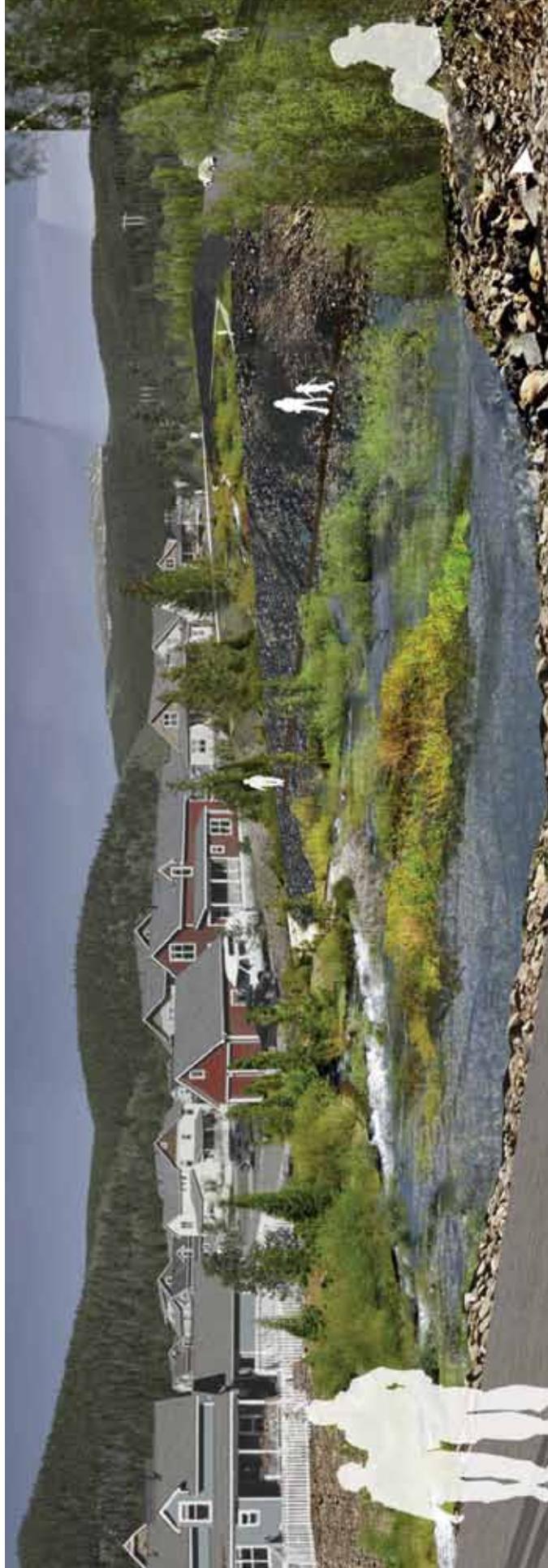
The perspective below envisions how the wetlands just above Dead Elk Pond will be enhanced. The wetlands will be expanded by excavating dredge rock to create pools and eddies for water flowing down French Gulch Creek. The wetlands will be designed to include a more extensive gradient of conditions: from submerged to seasonally wet. Dredge rock will be moved to realign the creek channel away from development phase I houses which are now perched on the channel edge.

All of these features will be accessed by a new trail system that travels the entire streambed from Dead Elk Pond to the upper wetlands above the housing. The trails will serve as a quiet retreat path in between the different parts of the neighborhood, and allow users to travel close to the water's edge and view the myriad aquatic habitats and vegetation. The trails will support pedestrian and bike traffic, and be constructed of onsite crushed rock, to keep short-term construction costs low and long-term maintenance costs down.



**existing**

## reclaimed



# PROJECT G: DEAD ELK POND

## Permeable Reactive Barrier Wall

French Gulch in the pre-mining era was a verdant mountain valley with a braided stream bed, interwoven stream channels, and a rich riparian vegetative thriving along its courses. The placer mining and associated dredging essentially turned the riparian corridor upside down. This created an extremely complex hydrological condition whereby water courses from up valley mix with groundwater flows underneath the dredge rock. Furthermore, the adits and lode mining waste that skirt the valley input acid rock drainage in several places. Thus, a simple input/output remediation design strategy will never remediate the entire valley's water system.

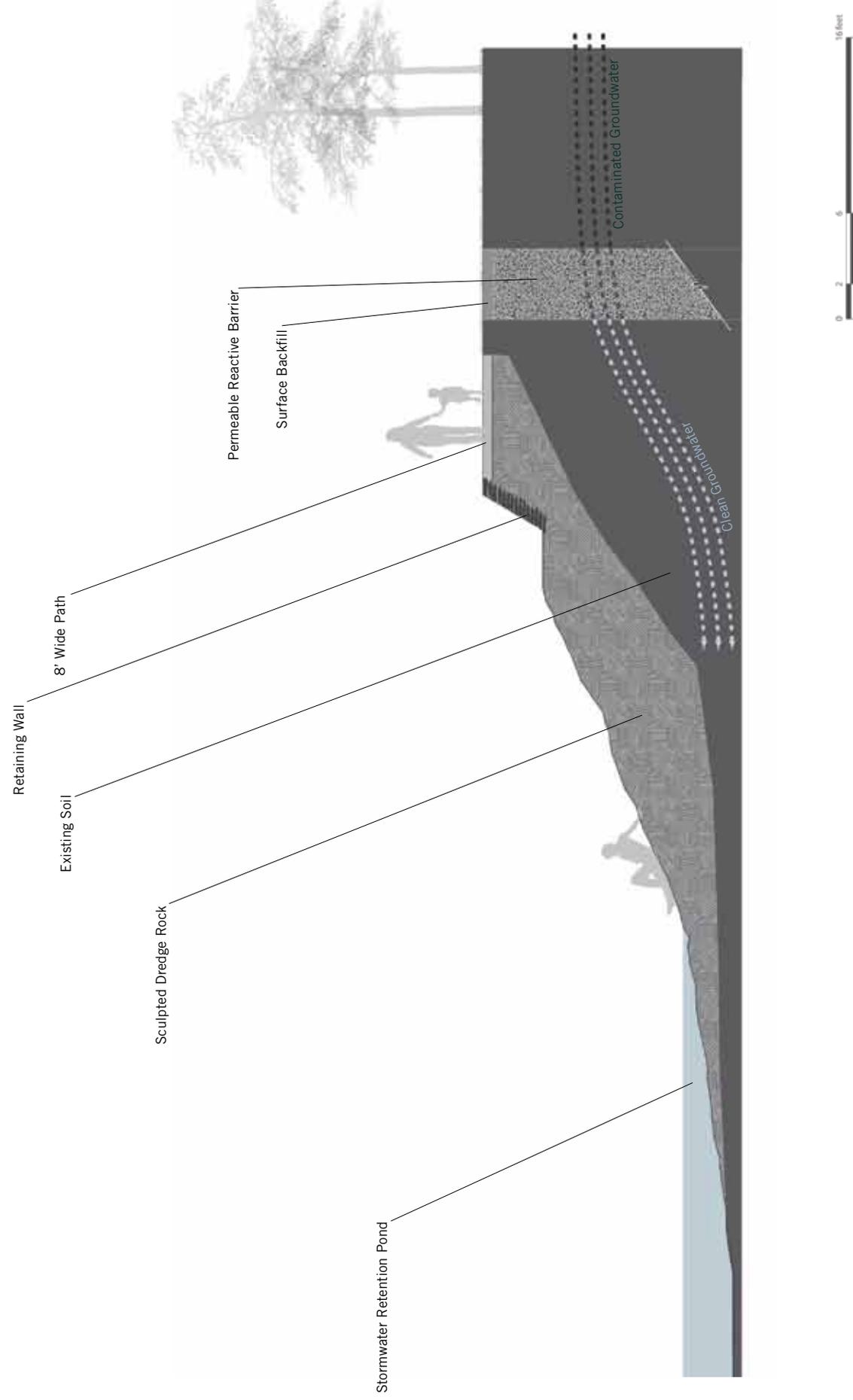
Instead, water treatment will be handled with a phased approach. The Town of Breckenridge and Summit County constructed a mechanical water treatment plant to treat the primary Wellington-Oro Mine acid rock drainage. The impact of treating this easily identifiable source of acid rock drainage will be measured in French Creek and the Blue River. If water quality goals are not achieved, then the EPA will evaluate options for treating the more dispersed, non-point source, acid rock drainage. Reclamation of the placer tailings would

be suspended until it is assured that the water quality goals are achieved. To allow for completing surface reclamation, the design incorporates potential passive treatment technologies that maybe used along the valley floor. Some technologies would result in disturbing the reclaimed landscape. Two of these technologies include constructed wetlands and the permeable reactive barrier wall (PRB). In the concept plan, a PRB could be located to intercept and treat groundwater flows prior to entering Dead Elk Pond. While constructed wetlands are being considered along French Creek.

The technology of PRB is explained below and in the illustration below. The PRB is located at Dead Elk Pond along edge of the Activity Green. Since it is not known if the PRB will become necessary in the future, its design is integrated into the major walkway from the community terrace down to the pond, which will be on top of the barrier wall itself. PRB walls are constructed of materials that either breakdown a polluting agent or immobilize it. The wall is permeable and thus allows flows of groundwater through its structure. In this process, the polluting agent may be broken by chemical reaction or captured in the wall by sorption. This

technology has been proven to significantly reduce concentrations of toxic metals, radioactive contaminants, and volatile organic compounds.

In this case, the PRB wall will be used to gather the dispersed inputs into the Dead Elk Pond area and passively treat them for dissolved metals before they enter the pond system itself. During the design refinement, the need may arise to construct slurry walls to funnel the contaminated groundwater toward the PRB. Although the wall itself is hidden, its surface expression will be a walkway that serves as the interface between the mining impacted water upstream and cleaner water downstream, simultaneously providing recreation access to the pond and an experiential lesson in reclamation. The walkway is designed to allow for construction and maintenance of the PRB.



# PHASING: Dead Elk Pond Ecology



base



5 year



10 year

Dry Seed Catchers

Wet Seed Catchers

# 15 year

North Face Vegetation

Dredge Rock



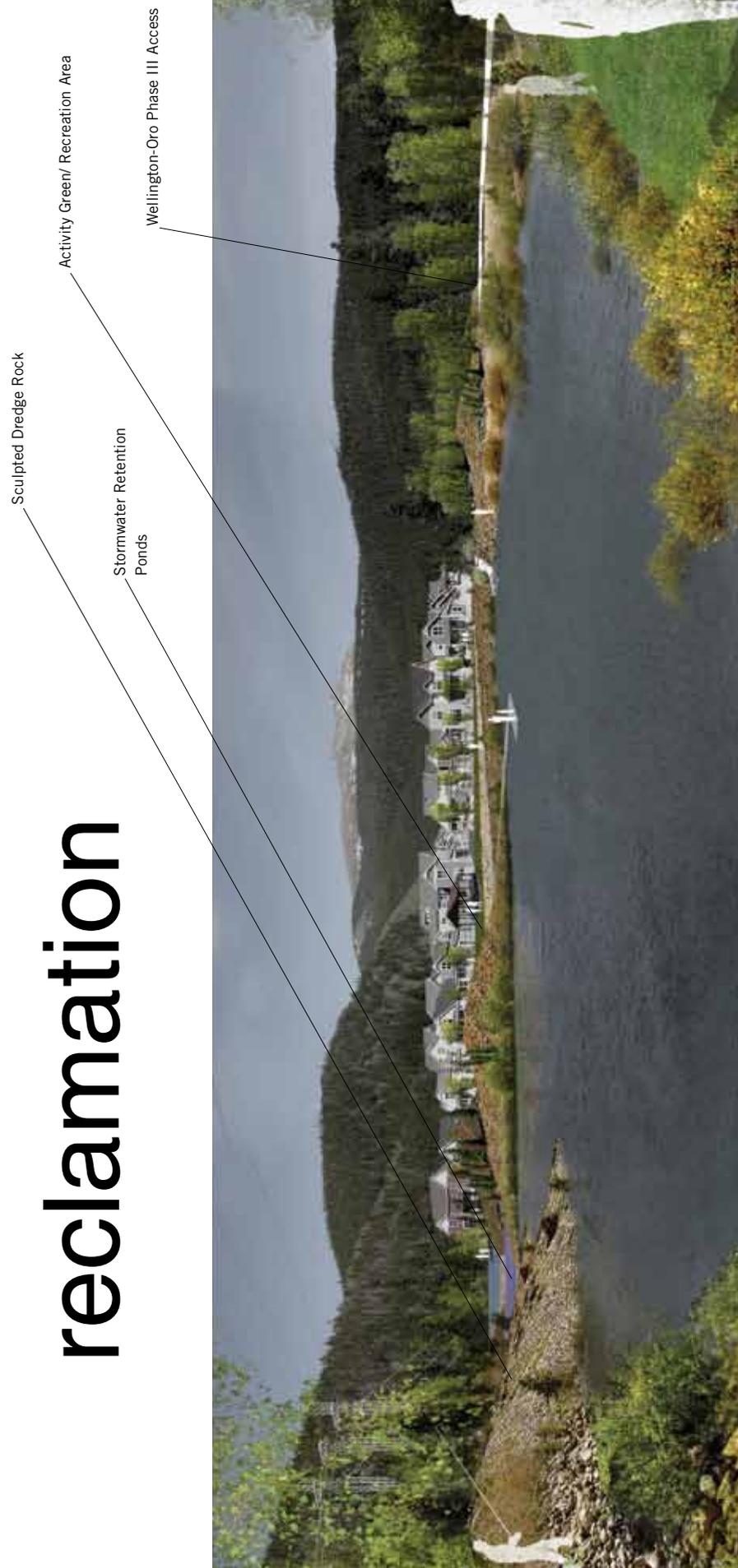
# DEAD ELK POND

## Perspective Across Pond



existing

# reclamation



# DEAD ELK POND:

## Community Center and Activity Green

The area located between Dead Elk Pond and the Wellington neighborhood consists of a Community Center and Activity Green. The activity green serves both as a 'green welcome mat' for people entering the Wellington neighborhood, and a soft, flat, flexible program space for local events. Next to the community center, visitors and residents can enjoy activities on the lawn or access trails to the more remote areas of the valley and back country. The activity green and community center area are centrally located and easily accessible for pedestrians, trail users, and car parking. It is also where trailheads for bikers and hikers, and a bus stop/shelter and parking are located ensuring multiple forms of transit access.



existing

# reclamation



This booklet provides a summary of an extraordinary project--the first of its kind in the history of the United States Environmental Protection Agency. The French Gulch site demonstrates how mine reclamation and redevelopment planning can be integrated and conducted concurrently. At French Gulch, a collaborative process provided a forum for discussing the varying needs of multiple stakeholders. Together with a unique collaboration between the United States Environmental Protection Agency's Superfund Program and The Project for Reclamation Excellence (P-REX, [www.theprex.net](http://www.theprex.net)), the resultant vision balances stakeholders' three primary concerns in reclaiming and redeveloping French Gulch: correcting environmental problems associated with abandoned mining, providing affordable housing, and open-space planning. What was once a vast landscape liability is now a valuable community asset, and exemplary demonstration project for re-envisioning hundreds of thousands of abandoned mining sites throughout the world.

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