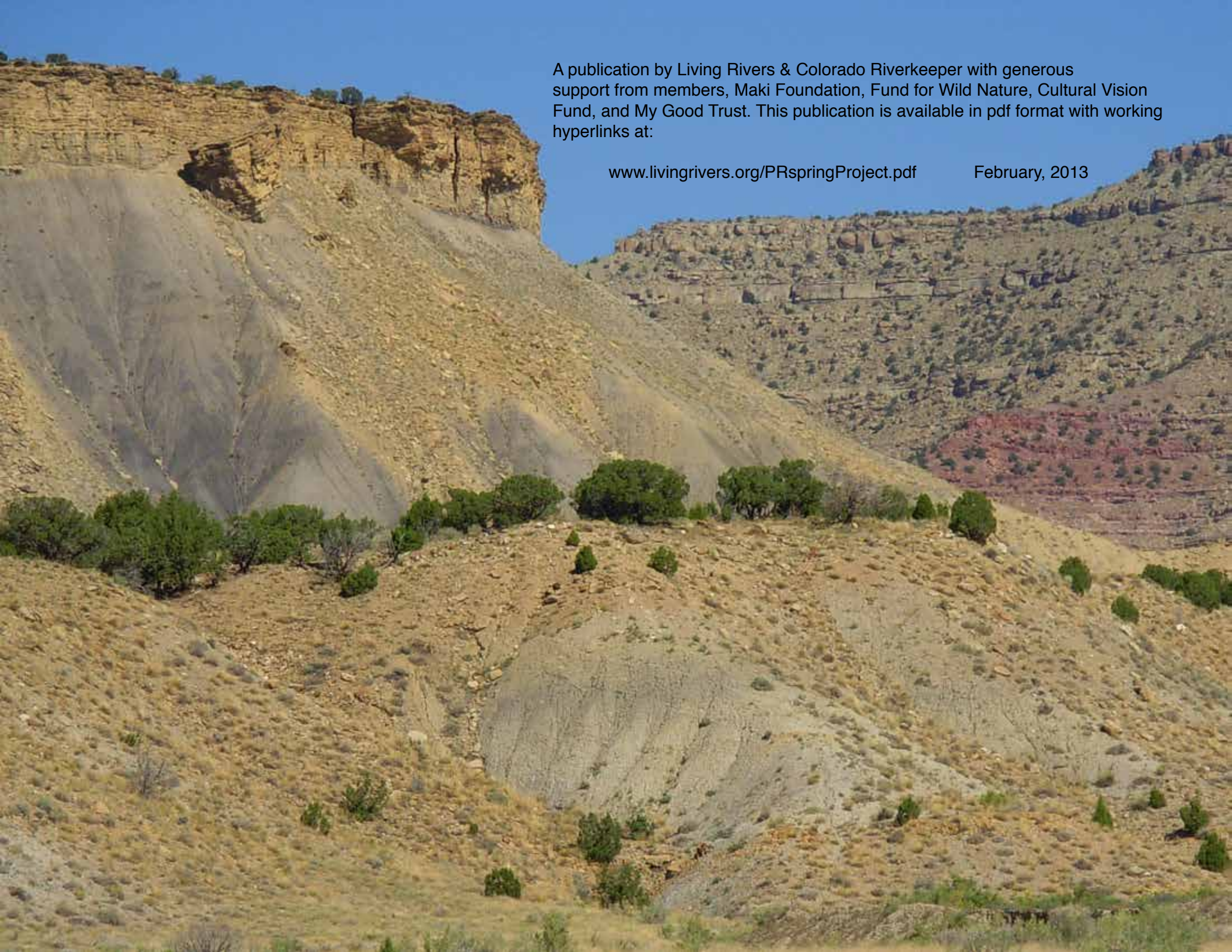
Utah Watershed at Risk!
Tar Sands Strip Mining in the USA



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www.livingrivers.org/PRspringProject.pdf February, 2013

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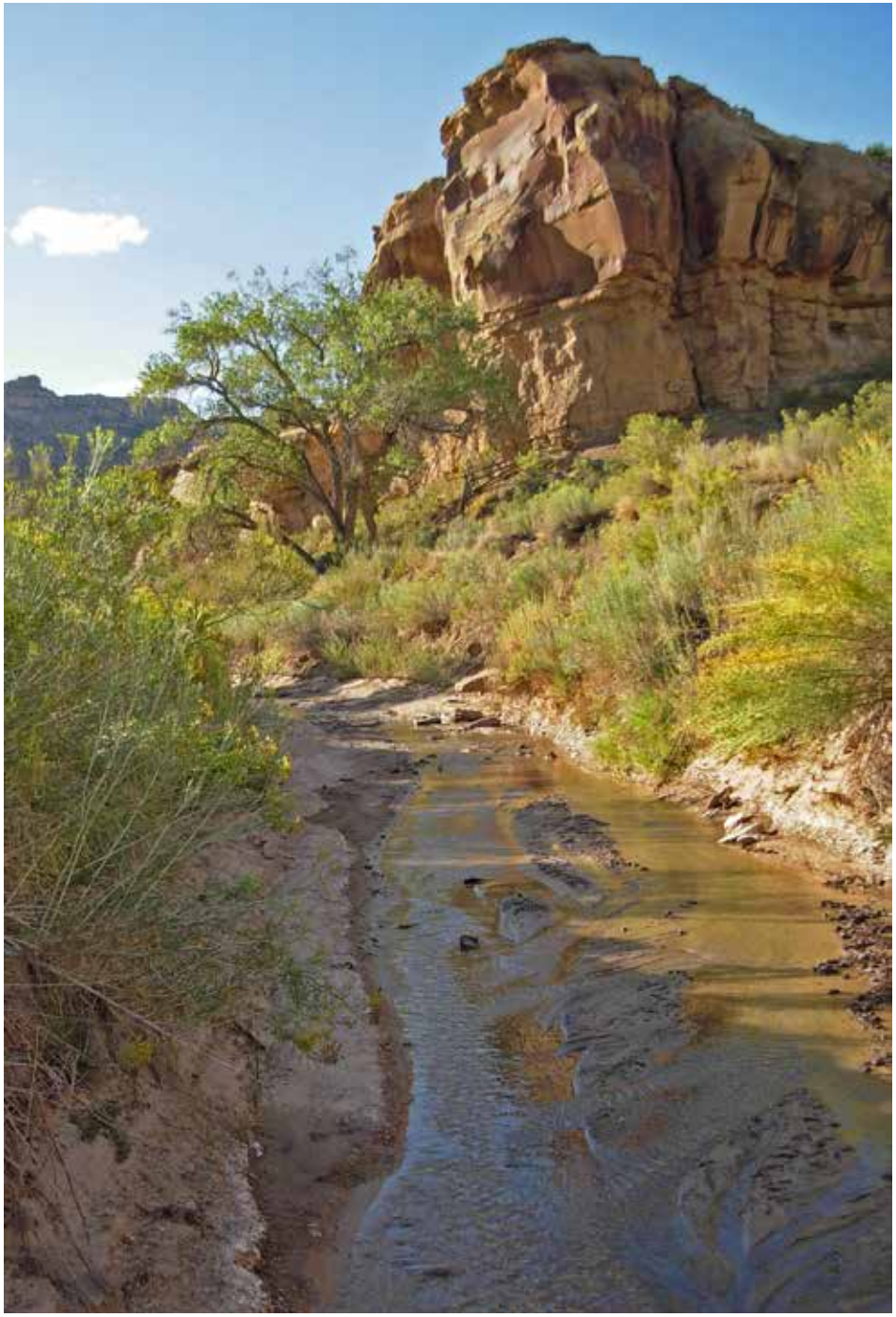
All photos are by Living Rivers, unless otherwise indicated.



Westwater Creek along Hay Canyon Road.

Strip Mining Tar Sands at PR Spring
A Watershed Event of Risk and Uncertainty

Introduction

There are eleven Special Tar Sand Areas (STSA) in the state of Utah and this booklet is about the one called PR Spring, which is located on the Tavaputs Plateau in east-central Utah. A corporation called US Oil Sands from Alberta, Canada could begin mining operations in one to two years. At present the permit is under litigation by a non-profit organization based in Moab, Utah called Living Rivers, which is responsible for the contents of this publication. Because our litigation is challenging the harm this permit will cause to water resources, the officers of this oil corporation are having difficulties securing start-up funds from investors.

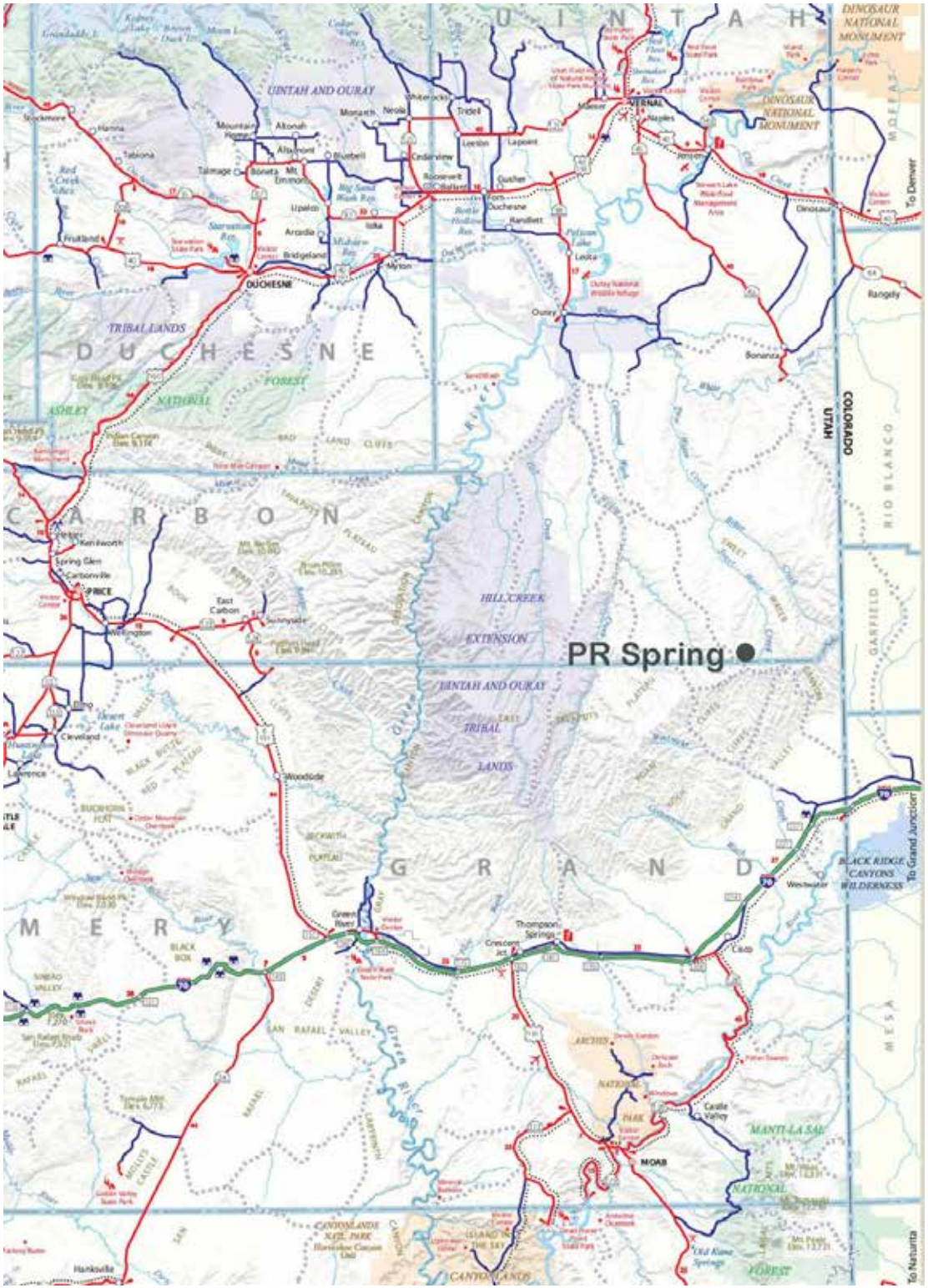
This potential mining district also has deposits of oil shale ("the rock that burns") because this dense siltstone is embedded with a waxy hydrocarbon called kerogen. In the near future we will produce a publication about Utah's oil shale deposits, since this hydrocarbon resource is also proposed for strip mining operations by several companies, both international and domestic.

In this publication we will demonstrate that strip mining unconventional hydrocarbons in Utah is a speculative proposition for the following reasons:

1) The energy value of Utah's bituminous sand deposits are half the value of conventional sweet crude.

2) Mining, processing, transporting and refining tar sands is energy intensive; this massive consumption of diesel fuel and natural gas lowers its energy value to one-third.

3) Water in the Colorado River basin is shared by over 35 million people and demand presently exceeds supply.



4) The groundwater yield for this project is not sustainable and the corporation will eventually have to invest in an expensive water delivery project from the over-allocated Colorado River system.

5) Water for this project could be curtailed during a declared shortage in the basin, since the corporation does not possess a senior water right, nor a high-value product.

6) Strip mining will destroy the function of this unique watershed, especially the near-surface aquifers that support the forest canopy and provide forage and habitat for the abundant wildlife.

7) The waste sand will become a vector to introduce toxins and carcinogens into the water supply of the Colorado River basin.

8) Operations will significantly reduce air quality, increase greenhouse gas emissions, and increase fugitive soot and dust.

9) Traditional economies will be impaired for many centuries, as will outstanding and diverse recreational opportunities.

10) Investments for renewable energy projects will be diverted.

Geographic Setting

PR Spring is named after a cowboy by the name of P. R. Kaiser, and the Tavaputs Plateau was named after a tribal leader of the Ute Nation.

A spring in Main Canyon at the base of the proposed strip mining operation by US Oil Sands near PR Spring. Photo courtesy of Porter Teegarden.

The Green River divides the Tavaputs Plateau into two halves: West Tavaputs and East Tavaputs. The river's gorge is called Desolation Canyon. The Tavaputs is a tilted structure and the southern edge has the greater elevation. The highest place is Point Bruin at 10,184 feet. The plateau's landscape is also bisected by numerous side canyons with very steep slopes of rugged terrain.

The southern edge of the plateau has two pronounced escarpments called the Book Cliffs and the Roan Cliffs, and the alternating rock layers resemble a stack of flat books, which are especially noticeable during a brilliant sunset. The Book Cliffs are the most continuous and sinuous escarpment in the world. This area is also known as the Uinta Basin, a section of the greater Colorado Plateau; sometimes the spelling of Uinta includes the letter H, or Uintah.

The PR Spring STSA in located in east-central Utah in the counties of Grand

and Uintah. The county seats are Moab and Vernal, respectively. The largest community in the immediate area is Grand Junction, Colorado. There are two national parks and two national monuments surrounding the Tavaputs Plateau, namely Canyonlands NP, Arches NP, Dinosaur NM and Colorado NM.

Bitumen: The Bottom of the Barrel

The desired product from a tar sands mine is a hydrocarbon called bitumen, which is a black and pitchy substance commingled with sand, or what was once a porous sandstone; bitumen is also called asphalt. The deposits were originally isolated reservoirs of immature crude, until natural erosion exposed them to the atmosphere, precipitation and bacteria; exposures that degrade the otherwise high volatility of a conventional crude oil. Raw bitumen will not flow like oil unless it is heated, or diluted with lighter hydrocarbons such as refined kerosene; diluted bitumen is called “dilbit.”

Abandoned processing facility (solvent-based separation) facility from a defunct tar sands operation of 1983 near PR Spring. Photo courtesy of Utah Tar Sands Resistance.

The uses of bitumen include applications such as: boiling water at a power generating station, a binder for sand and gravel in the paving of roads, and a waterproofing material for roof construction.

There are two methods to extract bitumen from the earth’s crust and the decision to use one process over another is based on the costs involved. When the ore body is near the surface, strip mining is the preferred method (ex-situ). If the ore is covered by too much overburden (rock with no economic value), then a massive drilling program is enabled using steam to heat the bitumen so that it can be pumped as a liquid to the surface (in-situ). The general rule that excludes a strip mining project is when the overburden is twice the thickness of the ore body.

To convert bitumen into a useful transportation fuel, if strip mining is the chosen extraction method, the tar must first be liberated from the host rock, which involves crushing and screening the ore, and then mixing it with hot water, or solvent, or a combination of water and solvent. At the refinery, the bitumen must be upgraded to become a transportation fuel which, for example, is accomplished by infusing hydrogen acquired from supplies of natural gas.

The energy value of this extremely heavy crude is about 50%, compared to 97% for conventional light crude. The preferred hydrocarbon for a transportation fuel is light crude because the profit margin and energy value is quite high, and the cost to

mitigate pollution is much lower. Now that the world reserves of light crude production have peaked, oil corporations are investing in extracting thicker crude, which was previously undesirable because the return on investment is poor.

Consequently, the development of heavier crude will not lower prices at fueling stations, and it will not increase the abundance of transportation fuels. It is a low-value hydrocarbon that will fill the gap when the supply of light crude diminishes, while simultaneously increasing the demand for high-value natural gas.

The production of heavy crude will increase the cost to maintain clear skies and good health. It will also increase the cost of providing clean water and safe food. Greenhouse gas emissions will continue to increase and alter long-term climate patterns in negative ways. For example, the magnitude and frequency of drought and flood will increase. Water stored in snow fields, glaciers and ice sheets will be reduced, and the ocean elevation will rise accordingly. The increased consumption of water caused by evaporation will dry soils, increase the volume of irrigation water applied to crops, and decrease the volume of water stored in man-made reservoirs. Species that require a specific habitat to prosper will become endangered, and the species that can adapt will decrease in numbers due to the reduction of forage.

A Serious First Attempt to Extract Tar Sands in Utah

In 1981, Congress passed the Combined Hydrocarbon Leasing Act with the intent to modify a leasing program of oil and gas parcels to include the extraction of tar sands in the Canyonlands District and the Uinta Basin. The Bureau of Land Management (BLM) spent four years developing management plans to lease tar sand parcels to the oil corporations. They acknowledged that the development of tar sands would industrialize these two districts of the Colorado Plateau. Some citizens angrily referred to this development as a means to transform the Colorado Plateau into an energy colony. A film documentary called *Four Corners: A National Sacrifice Area* won an Academy Award in 1983 about increasing energy development on the Colorado Plateau.

When the planning process was finished, the oil corporations decided to leave the tar sand deposits alone because of the risks and uncertainties, and began to develop Utah's conventional oil and natural gas fields instead.

It is still not clear if the major oil corporations are ready for the exploitation of bitumen and kerogen in the Colorado River basin and largely for the same reasons as in 1981: high investment costs for inferior crude and possible regional lawsuits from millions of people who depend on clean water and healthy air.

Tar seep at abandoned tar sands mine mixing with groundwater.
Note the entrapped magpie carcass in the foreground.

Water scarcity is a bigger issue now than it was in 1981. For example, in 2010 Shell Oil decided to abandon their acquisition of water rights from the Yampa River for the extraction of kerogen embedded in oil shale. This decision was partly based on the fact that the Colorado River basin has more water rights on paper, than actual wet water for project applications.

Back in the 1980s, the BLM provided a window into the future by demonstrating what the ancillary projects would include for actual large-scale mining operations on the Tavaputs Plateau: an earthen dam on the White River, water pumping stations and pipelines from various parts of the Colorado River basin, construction of the Book Cliffs Highway, conveyor belt systems for transporting ore, transfer stations along the railroad corridor from Grand Junction to Salt Lake City, power generation stations, coal mining to fuel that thermal power generation, railroads to deliver the coal, and electric transmission lines.

Though this infrastructure to develop an unconventional fuel industry never materialized, the impacts of traditional oil and gas exploration have none-the-less affected Grand and Uintah counties significantly. The air quality in the surrounding national parks are about to exceed the legal standards of compliance.

The Bureau of Reclamation has determined that over-consumption and climate change has, and will continue to, diminish the natural flow of the Colorado River. Consequently, this federal agency has initiated management plans to mitigate shortfalls in the regional water supply. It must also be appreciated that the state of Utah has yet to resolve the appropriation of water rights for the Navajo Nation and the Ute Nation. Additionally, the amount of salts and heavy metals entering the water supply of the Colorado River has increased more than the original expectations produced by the environmental reviews by the BLM in the early 1980s.

And finally, the recovery of endangered fish species in eastern Utah, where all the tributaries of the Colorado River convene, has not been resolved. In fact, the states of Utah and Colorado are investing resources to recover three threatened native fish species that may soon join the four species that are currently listed as endangered.

Exploratory pit near PR Spring. Courtesy of Southern Utah Wilderness Alliance.

History of Development in the PR Spring Area

1900 - The exploration for petroleum in the PR Spring area begins with John T. Pope (Uintah County Sheriff), who drilled 1,000 feet in Section 35 (Pope Well Ridge) without striking oil or natural gas. Additionally, there is a 50-foot adit in Section 34 that utilized a steel pipe to collect oil from tar sand deposits via direct gravity flow into a metal trough; this venture by an unknown person was also not successful. Natural gas development has dominated the PR Spring watershed for the last 60-years.

1936 - The Civilian Conservation Corps establishes a campsite and commissary where PR Spring flows near a grove of shady aspen trees. The workers initiated projects to enhance the accessibility and productivity of the watershed with basic hand tools. PR Spring is one of two public water reserves in the area.

1973 - US Bureau of Mines funded Utah Geologic Survey to drill 14 exploratory core holes in the PR Spring area.

1980 - The Laramie Energy Technology Center drilled seven exploratory core holes in the vicinity of PR Spring. The results, including other previously drilled cores, indicate the tar sand deposits are lenticular (lens-shaped) and discontinuous (having gaps); the average thickness of these lenses is 24-feet; average depth is 189-feet. The vast majority of the deposits will require steam-injection to extract the bitumen. The permeability and porosity of the beds decreases to the northwest; oil saturation decreases to the west-southwest; and water saturation decreases to the east.

1981 - The Combined Hydrocarbon Leasing Act is passed by Congress. Federal lands for pilot programs are proposed for leasing to oil corporations and environmental compliance documents are completed by the Bureau of Land Management. However, a successful pilot project never materialized. Two extraction processes were proposed: 1) heating the tar sands underground and pumping the bitumen to the surface (in situ); 2) strip mining and processing the bitumen with heat, hot water, chemical solvents, or combinations thereof (ex-situ).

1983 - A Salt Lake City oil company called U-tar (a Division of Bighorn Oil Company) was able to operate a pilot processing plant on private land in Section 5 at the head of Main Canyon, and using petroleum-based solvent to extract about 100 barrels-per-day. The operation was short-lived and the excavation and processing sites were never reclaimed. This site is polluting a freshwater spring.

1990 - The Book Cliffs Conservation Initiative (BCCI) is a cooperative effort between Bureau of Land Management, Rocky Mountain Elk Foundation, The Nature Conservancy, and Utah Division of Wildlife Resources. The effects of the BCCI on the future development of tar sand resources is unclear. The BCCI encompasses about 450,000 acres in the PR Spring area.

2005 - A Canadian oil corporation called Earth Energy Resources applies for a permit from Utah Division of Oil, Gas and Mining to commence a small mining operation near PR Spring. In 2008, ERR applies for a permit to begin a large mining operation. In 2011, EER applies for permission to begin an exploratory excavation and core drilling program. In 2011, ERR changes its name to US Oil Sands (Utah), Inc.

2008 - A study by the Congressional Research Service suggests that the development of tar sands in Utah may not be viable for reasons that include: 1) lack of abundant water for production; 2) challenging topography and climate; 3) ore bodies are isolated and not contiguous; 4) a high ratio of non-yielding rock layers to remove (overburden and intraburden) before the tar sand deposits can be processed.

2010 - Living Rivers and attorneys from Western Resource Advocates intervene and challenge EER's proposed strip mining operation through administrative law procedures.

2012 - The administrative appeal does not prevail and the litigation will now advance into the judicial branch of Utah government. If project investors are secured, mining operations could begin in 2014.

Natural History: PR Spring Special Tar Sands Area

Geology - The hydrocarbons in the PR Spring Special Tar Sands Area are located in a sedimentary rock called the Green River Formation, which began to accumulate about 50 million years ago in the Eocene Epoch, and specifically in two sub-layers called the Parachute Member and the Douglas Creek Member. The source material for the hydrocarbons is algae. By average weight the scattered ore bodies are 90.5% sand, 1.5% fines (clay), 7.5% bitumen, and 0.5% water.

The alternating layers of the Green River Formation consist of fluvial sandstone (sand transported by flowing water) and freshwater limestone (lacustrine), which indicate that a fluctuating continental lake (Lake Uinta) existed here for about 35 million years. In more recent geologic time, as the lake environment evolved into a river system flowing to the sea (the Colorado River), erosion began to dominate this landscape. Once these immature reservoirs of oil were breached by stream erosion, and exposed to the atmosphere, precipitation, and even oil-feeding bacteria, the liquid crude was reduced into a tarry, low-value hydrocarbon called bitumen (asphalt).

Water - The PR Spring area is a watershed divide, especially near Stevenson's Corral (Section 33), and precipitation will flow to one of three rivers: 1) PR Canyon/Evacuation Creek drains into the White River; 2) Main Canyon/Willow Creek drains into the Green River; 3) Middle Canyon/Westwater Creek drains into the Colorado River. Willow Creek is designated as an impaired water course for reasons of high loads of dissolved solids.

The annual precipitation of the East Tavaputs Plateau is 10- to 18-inches per year. It is dryer in the northern sections than the southern. Annual evaporation rates range from 48 to 56 inches; evaporation is about four times greater than precipitation.

Because PR Spring is very close to the escarpment of the Roan Cliffs, storm clouds condense and drop their moisture more readily here than in other areas of the Tavaputs Plateau. This explains why springs are so prevalent in the area, and why Westwater Creek flows all year long.

Elevation - The elevation of the Green River at the Ouray Bridge, where the Duchesne and White rivers join the Green River, is about 4,650-feet and the high points of the East Tavaputs Plateau are around 9,300-feet. The elevation at PR Springs is about 8,200-feet. The highest point on the West Tavaputs is Bruin Point (headwaters of Range Creek) at 10,184 feet.

Climate - Maximum high temperature is 108°F (42°C). Maximum low temp is -40°F (-40°C). The average July temperature is 70°F (20°C). The average January temperature is 14°F (-10°C). The area is frost free 60 to 110 days of the year (average is 85 days).

Air Quality - Largely unknown due to lack of monitoring equipment in the immediate vicinity. Where monitoring equipment does exist, the levels of ozone are known to be extreme, especially in the winter, and largely due to fugitive emissions from natural gas operations in the Uinta Basin. The Environmental Protection Agency disclosed in 2010 that ozone pollution exceeded the established health-based standard for 68 days. In 2011, the exceedance nearly doubled. In 2012, a lawsuit was filed by Earthjustice.

In 1991 the Bureau of Land Management acknowledged that tar sands mining would result in temporary violations of PSD (Prevention of Serious Deterioration) Class II TSP (Total Suspended Particulates) standards.

Soils -The soils in the PR Spring area are loam or clay loam, well-drained, and contain varying amounts of rock fragments (10 to 65 percent) that range in size from gravel to stone. The thickness of the soils on the flats are moderately deep. Whereas the soils on the steep slopes are moderately shallow and sensitive to disturbance.

Vegetation - The vegetation of the PR Spring area is 18.6% grassland; 16.7% sagebrush and grass: 21.2% pinyon & juniper; 36.5% mountain shrub & oak; and 7% mixed conifer and aspen.

Wildlife - This canopy of vegetation provides habitat and forage for deer, elk, bear, bison, turkeys and grouse. Wild horses are also known to forage in the vicinity. The grasslands are known as crucial forage for deer and elk, especially when a hard winter hits eastern Utah.

The headwaters of Middle Canyon from Book Cliffs Divide Road near PR Spring Special Tar Sands Area. This drainage flows into Westwater Creek and then the Colorado River. The rim, on the right, contains isolated lenses of tar sand deposits. The ledges are limestone and the slopes are sandstones from a fluctuating, continental lake that once-existed here for about 35-million years and called Lake Uinta. The land belongs to the state of Utah (SITLA) and leased at bargain rates.

Predators include cougar, kit fox, coyote, hawks, owls, accipiters, falcons and eagles. Golden eagles are known to nest here in the summer, and bald eagles nest in along the Colorado River in Grand County.

Sensitive Species - Grand County has the highest concentration of endangered humpback chub in the upper Colorado River basin at Ruby and Westwater canyons. The Green River provides the best available habitat in the Colorado River basin for the recovery of humpback chub, Colorado pikeminnow, razorback sucker and bonytail chub. Wild bonytail chub no longer exists; the rivers have been stocked with bonytails raised in hatcheries.

The confluence of the Duchesne and Green rivers is a very sensitive breeding habitat for endangered fish. This location is also where the White River and Willow Creek converge. The headwaters of Willow Creek includes Main Canyon near PR Springs.

PR Springs is a known breeding habitat for the threatened Greater sage grouse and the endangered Mexican spotted owl is known to forage here.

Threatened plants include the Uinta Basin hookless cactus. Species of concern include debris milkvetch, Ferron milkvetch, San Rafael milkvetch, Caespitse cat's-eye, Osterhout cat's-eye, grand buckwheat, ephedra buckwheat, narrow-stem gilia, Dolores River skeletonplant, Graham's beardtongue, White River beardtongue, clay reed-mustard, shrubby reed-mustard, Ute ladies'-tresses, and Strigose Easter-daisy.

Sensitive insects include the Great Basin silverspot butterfly, and sensitive amphibians include northern leopard frog and Great Basin spadefoot. Sensitive reptiles are smooth greensnake.

Sensitive bats include the Townsend's big-eared bat, spotted bat, Allen's big-eared bat, Western red bat, fringed myotis, and big free-tailed bat.

BLM Wilderness - The closest wilderness study area is adjacent to PR Spring and called Winter Ridge (42,462-acres or 60-square miles). In an Environmental Impact Statement written in 1991, the BLM recommended that the use of this land was better suited for extractive industries, such as stock grazing, oil and gas development and tar sands exploitation, even though 84% of the land is natural and the 75% is suitable for solitude.

Within the boundaries of this suitable wilderness area, 45-acres of juniper and pinyon were chained to create more grassland for grazing. About 35,500-acres have tar sand deposits within the eastern section; the tar sand deposits are 10- to 15-feet thick, but the deposits in the western section are of poor quality.

The next closest BLM wilderness study area is Flume Canyon, but the area is contiguous with four other wilderness areas that include Spruce Canyon, Coal Canyon and Floy Canyon. The total contiguous acreage is about 48,000-acres. These wilderness areas are in Grand County and are adjacent to the contiguous parcels of SITLA land set aside for the development of tar sands.

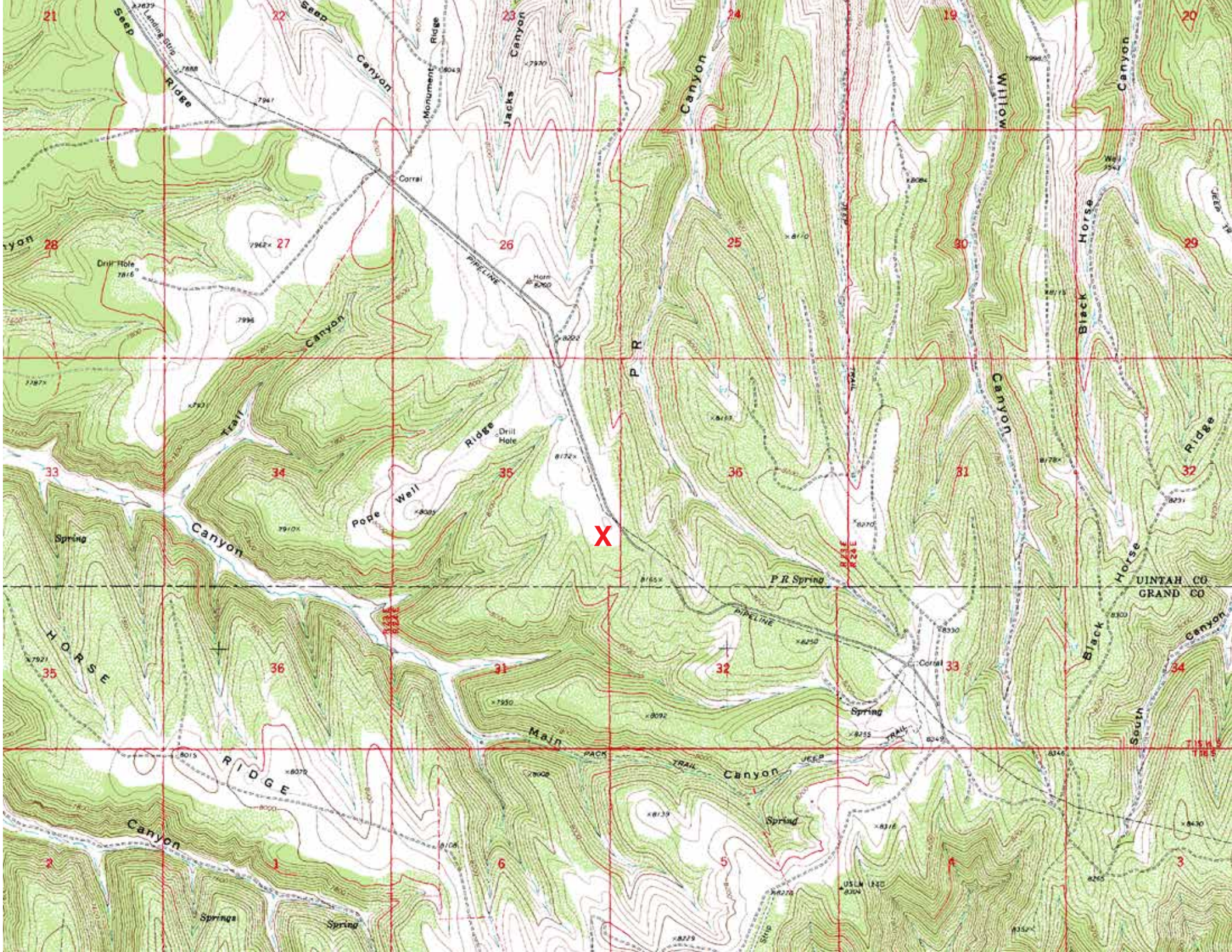
Flume Canyon is adjacent to the perennial stream, Westwater Creek. Beaver is a dominate critter of these wilderness areas. Birds include the Western yellow-billed cuckoo, long-billed curlews, Southern spotted owls, and ferruginous hawks. The endangered black-footed ferret has critical habitat in these wilderness areas.

Additional information:

1) Citizen Wilderness Proposals are more extensive in the Tavaputs Plateau.

2) At present, the only proposal for electric power generation in the affected mining area is a 3,000 MW nuclear-power plant to be located in Green River, Utah. The water rights application for this proposed power facility is currently under litigation.

Following page: USGS Topo Map (PR Spring). The **red X** near the center is the proposed mine by US Oil Sands, Inc.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Permit Application of US Oil Sands
A Demonstration of High Risk and Low Returns

US Oil Sands Inc. is a Canadian company using the advantages of working within the current policies of the United States and the state of Utah. These policies do not include reversing the atmospheric loading of greenhouse gases, the denial of subsidies, or minimizing consumption rates of natural resources that are not renewable. This company has also targeted state-owned lands and state regulatory agencies to avoid litigation in the federal court system. These agencies include Utah School and Institutional Trust Lands Adminstration (SITLA), Utah Division of Oil, Gas and Mining, Utah Division of Water Quality, and Utah Division of Air Quality. US Oil Sands has also appealed directly to Governor Herbert for assistance to fast-track their mining project.

As explained in Utah's 10-Year Strategic Energy Plan (2011), the ultimate goal of Utah politicians is to secure energy resources in the state to "have a stable and sustainable business-friendly environment." This document fails to mention that Utah does not have adequate water resources for any more growth, and this business-friendly environment has initiated growing concern about the ever-worsening air quality in Salt Lake City and the rural communities of eastern Utah.

For example, the state of Utah has not updated their water resource plan since 2001. However, the Bureau of Reclamation completed a supply and demand study on water resources in the states of the Colorado River basin in 2012 and with Utah's assistance. This budget concluded that the demand for water in the Colorado River basin now exceeds the natural supply. The gap is greater than the total annual consumptive use within the state of Utah.

Table 1: Size of US Oil Sands strip mining operation

Description	Size	Description	Size
Total mining site	213 acres	Storage: over & intra burden	70 acres
North Pit (Phase I)	62 acres	Storage: top soil	18 acres
West Pit (Phase II)	31 acres	Roads	17 acres
Processing plant	15 acres		

Additionally, the state of Utah does not have a 10-year strategic plan to improve their worsening air quality from industrial and transportation pollution. It is true that the state is currently drafting a plan to clean Utah's dirty air, but the incentive to finish the process is to qualify for federal funding to increase the state's highway infrastructure for business. If the concern was about improving community health, Utah officials would have lowered the emission levels 20-years ago.

Table 2: USOS mining, processing goals and project lifetime

Mining Pit	Years to complete project	Processing goals per day (350 days per year)
North Pit (62 acres)	3.3 years	3,000 to 3,500 tons of ore
West Pit (31 acres)	1.65 years	2,000 barrels of bitumen
Total: 93 acres	Total: 5 years	

Phase One of Large Mining Operations

US Oil Sands intends to strip mine a 213-acre site to process bitumen into usable transportation fuels. The refineries are located in the Greater Salt Lake City area and currently process diluted bitumen from Canada. The raw bitumen will be initially processed at PR Spring and the heated liquid will then be transported to the refineries in Salt Lake City via insulated tanker trucks, otherwise the bitumen would solidify.

A solvent called d-limonene (a terpene) is used to lower the overall demand for production water, but this solvent is expensive ($36 per gallon). The water and the solvent are heated to 180°F using natural gas. The processing plant recycles the water and solvent using centrifuges. Since the waste sand and clay retain water, solvent (15% on average), and mobilized carcinogens, these compounds will either evaporate into the atmosphere or percolate into the ground; melting snow and summer cloudbursts will help to disperse these liquids into the aquifer or into the stream beds.

Table 3: Minimal water need for USOS 93-acre strip mining project

Gals. per minute	Gals. per day	Gals. per month	Gals. per year
116	167,040	5,011,200	60,134,400

Acre-feet per year	Gallons for life of project
185	300,672,000

Table 4: Yield of bitumen from USOS North and West pits

Total barrels per acre for PR Spring STSA	Expected yield at the USOS Mine	USA oil consumption in 2007
37,700 barrels per acre (average yield)	3,506,100 barrels in five years	833,333 barrels per hour 3,333,332 barrels in 4 hours 20,000,000 barrels per day

The waste materials are transferred into the excavated pit, which is unlined. The waste pit is then contoured and covered with at least 6-inches of top soil and seeded with grasses and forbs; the forest canopy will not be replaced. Since a mining site on the Tavaputs Plateau has never been reclaimed before at this magnitude, the success of such a restoration project is yet to be determined. The velocity of winds in the Tavaputs Plateau will likely remove the soil or bury it under dunes of waste sand.

The operation will provide about 100 jobs and nearly every employee will be operating a transportation vehicle or heavy machinery. For every three units of energy produced by this operation, US Oil Sands and the refineries will consume a unit of that energy to market the final product (the energy value of conventional oil is usually 10 to 1).

Housing will have to be provided by the company on site, since a daily commute to the job site from distant urban areas is not practical.

It is possible that ever-increasing fuel expenses will encourage consumers to find transportation alternatives to reduce their household budgets, thus decreasing the need to extract and refine heavy crudes, which only ensure that fuel prices will stay high, that community health will be diminished, and critically important watersheds will be seriously degraded.

Table 5: Amount of water contained in the waste sand

Water necessary to process one barrel of bitumen	Waste water contained in waste sand per barrel of bitumen	Total waste water for the lifespan of the North and West pits
73.5 gallons (averaged)	11 gallons (averaged)	41,636,100 gallons (averaged)

Table 6: Amount of d-limonene solvent expelled into the environment

Citrus-based solvent to one gallon of water	Total water consumed per day	Total solvent used per day	Solvent expelled into the environment per day	Solvent expelled into the environment for life of project
30% (averaged)	3,500 gallons (averaged)	1050 gallons (averaged)	158 gallons (estimated)	276,500 gallons (estimated)

Note: Estimates and averages in the six tables of this section are based on the data provided in the USOS application and are biased to be conservative.

US Oil Sands stripping the vegetation to prepare for exploratory drilling near PR Spring.

The Water Budget: The Supply Is Insufficient For the Proposed Demand

Water is the gift of the Colorado Plateau and we cannot afford to live without it. This is a patient we must not lose."
Overheard at a public meeting about tar sands and oil shale.

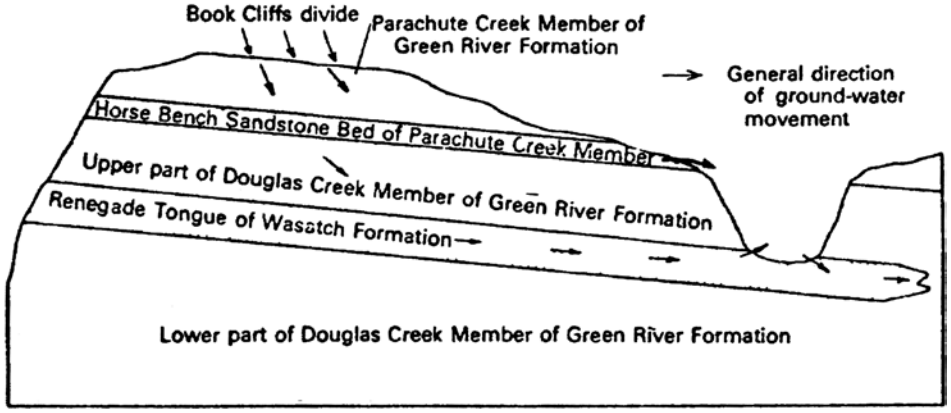
Before human emigration to the Colorado River basin, surface water was in ample supply and aquifers were fully charged, a situation that has reversed itself in less than 100-years. When Lake Mead began filling in front of Hoover Dam in 1935, the surplus in the basin's water budget was 50%. When Lake Powell began filling before the face of Glen Canyon Dam in 1963, the surplus was 20%. When US Oil Sands presented their mining application in 2008, the surplus had already vanished.

The water supply is not the problem, for the Colorado River is performing as it always has for the last six million years. The problem is the over-reaching demand for water supplies by humans. Allowing any diversion of water to occur beyond the carrying capacity of a limited resource is poor management. If a permit is granted under a situation of water scarcity, then the proposal is indeed speculative and the potential value from mining low-value hydrocarbons locked in rock formations is moot.

If your wondering how this situation is even tolerated, then you understand that energy development of any magnitude cannot proceed unless significant changes are made in the "Law of the River," which are the foundation documents for managing Colorado River water (and groundwater) for seven states, the First Nations and Mexico. Such legal modifications will be costly, time-consuming, and extremely difficult to negotiate.

Groundwater Resources

The Uinta Basin is about 10,000 square miles. The southern half of the basin is 4,900 square miles. The east-flowing Duschene River and the west-flowing White River is what divides the southern and northern halves of the Uinta Basin.



Schematic representation of groundwater flow to springs and near Hill Creek and PR Spring Specail Tar Sands Area. From Kimball, 1981

The aquifers in the northern half are recharged by the lofty Uinta Mountains and the high elevation Wasatch Plateau. This is why the northern half have small towns with economies based on irrigated agriculture. But the southern half (Tavaputs Plateau) has less recharge potential and agriculture and stock raising is limited to isolated ranches where saturated groundwater of significant quantity can be located; upper Main Canyon near PR Spring is such an example.

The Search for Goundwater to Mine

The first comprehensive inventory of groundwater supplies occurred in 1971 (Price & Miller), and the determination of the report indicates that the groundwater capacity of the Tavaputs Plateau would not support any large-scale development of unconventional fuels and the hoped for return on capital investments toward the development of unconventional fuels is marginal at best.

Though the PR Spring area has numerous wells and springs that are properly registered with the Utah Division of Water Rights, the water here is already dedicated to growing hay, and watering stock animals and wildlife populations. Consequently, US Oil Sands has decided to acquire groundwater at depths below 2,000 feet.

US Oil Sands requires 116 gallons per minute for their initial 62-acre excavation pit. In the summer of 2011, an exploratory well was drilled by the company to a depth of 2,000-feet and the hole was found to be dry. The well was plugged with concrete as mandated by public law. Two more attempts were made to find water and these holes too were dry. As the fall approached, US Oil Sands finally found groundwater perched below Pope Well Ridge and the pump test revealed a yield of 93 gallons per minute.

At some point in time the aquifer the company has tapped into will be mined of its liquid contents. This eventuality will come with a warning when the water becomes too salty to be used.

USOS exploratory well #4. This and three previous wells were abandoned and plugged with concrete.

Discharging salty water into the Colorado River watershed is prohibited by the Clean Water Act and the Salinity Control Act, unless it is purified by a water treatment plant.

Increasing the production rate of bitumen mining in the watershed will make that day of reckoning arrive even sooner, and it will be necessary for US Oil Sands to budget for production water shortfalls. The remedy would include trucking distant water to the site, which means taking water from a community that may, or may not have, a surplus of water.

Mule deer at the campground next to PR Spring. The hearth is a remnant of a camp kitchen established by the Civil Conservation Corps in the 1930s. Photo courtesy of Before It Starts.

Finally, US Oil Sands will to forced to finance and build a pump house along the Colorado, Green or White rivers, a 50-mile pipeline, and a storage reservoir. Since the Colorado River basin is over-allocated, a project to divert river water for a large tar sands operation of marginal energy fuels will be fiercely litigated.

Did you know that the natural tar seeps in the PR Spring mining district are caused by the weight of shallow groundwater? The pressure squeezes the bitumen out of the host rock and then it flows like melted wax over the ground.

Conclusion

Wild turkeys near Westwater Creek. Photo courtesy of Jeremy Miller.

The extraction of tar sands and oil shale is an inappropriate activity for the Tavaputs Plateau, because it is a destructive one-time use of a precious landscape and the waste of a valuable watershed. It best serves humans and wildlife to remain as it is, and it would be more productive to start reclaiming all the abandoned mines and well pads to increase the watershed's health and productivity.

Over-consumption of finite energy and water resources is the most pressing problem facing the generations of the future. Our organzation supports immediate policies to promote conservation, energy efficiency, and the decentralizing of power utilities so that the installation of simple solar applications can begin on existing roof structures and other developed landscapes.

We heartily invite families and friends to wonder out through the Tavaputs Plateau and enjoy the vistas, the solitude, the shady forest canopy, and the abundant and diverse wildlife.

Lastly we quote Aldo Leopold, who wrote about the Colorado River basin frequently, and who understood how unbalanced industrialism could destroy our last remaining wild places:

> "Having to squeeze the last drop of utility out of the land has the same desperate finality as having to chop up the furniture to keep warm."

Living Rivers & Colorado Riverkeeper
PO Box 466 • Moab, UT 84543

Above: Female elk on the Tavaputs Plateau. Photo courtesy of Before It Starts.

Left: Antelope on the Cisco Desert

List of unconventional oil corporations in Utah that have approved permits or likely to be issued permits soon

Company (proposals)	Ore & Extraction method	Feedstock processing	Location in Unitah County Utah	Land agency & Acreage	Barrels per day	Proposed start up & Obstacle
US Oil Sands (Canada) Large mining permit* Small mining permit* Presentations	Tar sands (bitumen) ex-situ Website	Hot water & solvent Heat source: natural gas Open loop "Ophus"	PR Spring T15S, R23E Section 36 Map	State 32,005 acres Google Earth .kmz	2,000	2010 Under litigation
Red Leaf Resources (USA) Large mining permit* Small mining permits: 01; 03; 04; 06; 07; 08; 09 Presentations	Oil shale (kerogen) ex-situ Website	Retort: earth ovens Heat source: natural gas Closed loop "EcoShale"	Seep Ridge Block T13S, R23E Section 30 Map	State 17,000 acres Google Earth .kmz	9,500	2012 Under litigation
TomCo (UK) (Using Red Leaf technology above) Presentations	Oil shale (kerogen) ex-situ Website	Retort: earth ovens Heat source: natural gas Closed loop "EcoShale"	Holliday Block T12S, R24E T12S, R25E Map	State 2,918 acres total (1,000 @ Holliday Block) Google Earth .kmz	9,800	2012 Under litigation
Enefit (Estonia) (White River Project) Large mining permit* Presentations: 01; 02; 03;	Oil shale (kerogen) ex-situ Website	Retort: mechanical oven Heat source: natural gas Closed loop Heat to generate electricity	White River RD&D T10S, R24E Sections 22 & 27 Map	Federal 5,000 acres State 4,000 acres Private 21,000 acres Google Earth .kmz	50,000	2020
Ocean Enterprise Group Website?	Tar sands ?	?	Asphalt Ridge	Federal Private	?	?
Temple Mountain Energy (USA) Large mining permit* Presentations	Tar sands (bitumen) ex-situ Website	Hot water Heat source: natural gas Closed loop "Diablo"	Asphalt Ridge (Map) T5S,R22E Section 31	State 1,200 acres Google Earth.kmz	500	2012 Non-renewal of credit
MCW Energy Group (Canada) Water discharge permit Presentations	Tar sands (bitumen) ex-situ Website	Solvent Heat source: natural gas Closed loop	Asphalt Ridge Crown Asphalt Mine T4S, R21E, S30 (Map)	State & Private Google Earth .kmz Feed stock from Temple Mountain Energy	250	2013 Mine application pending

*Username & password for Utah Division of Oil, Gas & Mining web sites is: ogmguest

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www.westernresourceadvocates.org/media/pandp.php

Oil Shale Facts. Official website for a coalition of conservation groups resisting the development of oil shale in Western Colorado.
www.oilshalefacts.org

On The Colorado. A website produced and maintained by the Colorado Riverkeeper that serves as a document archive about important issues related to the management of the Colorado River basin.
www.onthecolorado.org

Administrative Record: PR Spring Mine

Utah Division of Oil, Gas and Mining (UDOGM)
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- Docket, PR Spring litigation, Part One: http://tinyurl.com/aswvowe
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- Lease :www.riversimulator.org/Pubs/OSTS/Ref/SITLAlease.pdf
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Maps

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How to get to PR Spring via US Highway 40

You can visit PR Spring from Highway 40 in north-eastern Utah. This is the highway that passes through Roosevelt and Vernal. Between these two towns, there is a junction for Highway 88. Going south on Highway 88 will take you to the community of Ouray and Pelican Lake.

When you cross the bridge over the Green River you are on Seep Ridge Road, or Uintah County Road #2810. Soon, you will cross the bridge over the White River. Seep Ridge Road is partly paved and partly under construction. Stay on Seep Ridge Road for about 52 miles and you will eventually arrive at PR Spring.

Note: When you see road signs for Indian Ridge, you are traveling through oil shale deposits near the surface and are in the vicinity of Red Leaf Resources' experimental mining operation.

How to get to PR Spring via Interstate 70 Near the Utah/Colorado State Line

Your objective is to take Hay Canyon Road to Divide Ridge Road and finally to Seep Ridge Road. This adventure will take all day. Take an ample supply of water, some non-perishable food, and a sleeping bag. Make sure you have a full tank of gas and your spare tire is in good condition; bring some basic tools and a shovel. You don't need four-wheel drive, unless it has recently rained or snowed. If you slip and slide on the approach, you should abandon the trip until road conditions improve.

If your traveling westbound on I-70, take Westwater Exit 227. Turn right at the bottom of the off ramp and go to the junction of old US Highway 6 & 50 and then turn east (right). After you pass an industrial facility on the right side, look for a junction on the left that has a paved road heading toward the Book Cliffs. The pavement will eventually end, but this road will take you to the mouth of Hay Canyon, which is the quickest approach to PR Spring from I-70 (directions continue in the last paragraph of the next column).

If you traveling eastbound on I-70, get off the interstate at the Sulphur Exit 221. This exit is also the approach to the Westwater boat ramp on the Colorado River. Drive across the overpass and look for this sign:

The road going to Sulphur Canyon will not get you on top of the Tavaputs Plateau; your destination is Hay Canyon. After turning right you will soon cross over a bridge that spans Westwater Creek.

This road also parallels I-70 for awhile and then veers to the north and follows Westwater Creek. You will soon come to a junction and turn right. There is a sign that marks this junction to Hay Canyon. This road eventually dead ends at a black-top road. If you turn right, it will take you back to I-70 via Westwater Exit 227. Turn left on the paved road to continue your journey to Hay Canyon.

The pavement will turn into dirt and soon you will see an abandoned sheep ranch and then a natural gas compression station on the left. The road will soon veer over 90 degrees to the left. There is an entrance to some private property at this bend. Soon you will cross Westwater Creek, which is usually flowing and very shallow; the stream bottom is not soft. The road will then get curvy and steep, and soon you will see a hay ranch/bed and breakfast. Soon you will come upon another junction and the sign looks like this:

The quickest way to PR Spring is via Hay Canyon, but you can also get there via East Canyon if you have the time. The East Canyon approach is quite scenic. If you decide to take this route, once you ascend to the top of the plateau, turn left. This road is called the Book Cliffs Divide Road, and the watershed divide between the White and Colorado rivers.

The Hay Canyon route follows Westwater Creek and you will cross it five more times. This route was used by fur trappers as early as 1837. You will encounter other junctions, but remain on Hay Canyon Road. Eventually you will make a steep climb to the top and the vegetation turns into a forest of Douglas fir. When you reach the Divide Ridge Road, turn right (If you turn left, you will approach the Bookcliffs Roadless Area).

Divide Ridge Road is the watershed divide between the Colorado and Green rivers. Take this scenic road until you reach the junction of the Book Cliffs Divide Road. Look for deer, elk, and soaring eagles in this area.

When you see the sign below, you have reached the Book Cliffs Divide Road. Prior to reaching this sign, you would have noticed an old tar sands mine and processing machine on the left that was never reclaimed. **Cell phone coverage at this junction is excellent for Verizon users.**

You are still in Grand County. After you turn left at this junction you will enter Uintah County and the name of the road will change to Seep Ridge Road (# 2810).

Next, you will see the Stevenson Corral. This junction is called PR Junction and the road to the right will take you to PR Canyon, PR Spring and the BLM campground.

This junction is in Section 33 where drainages will end up in either the White, Green or Colorado rivers. Proceeding on Seep Ridge Road will take you to the exploratory pit of US Oil Sands, Inc.

You may encounter signs advising you not to trespass on the mining site. It is understood that with prior permission granted, you can visit the proposed mining site.

PR Spring at a BLM campground in Uintah County.

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