Site Remediation Plan for Oil and Gas-Related Spills in Red Bluff Draw, New Mexico

August 5, 2015

PREPARED FOR

THE NEW MEXICO STATE LAND OFFICE

PREPARED BY

GL Environmental, Inc.
P.O. Box 1746
Las Vegas, NM 87701
(505) 454-0830
www.glenvironmental.com

Contents

Introduction

Red Bluff Draw is a sizable intermittent surface water drainage that converges with the Pecos River 5.5 miles north of the Texas / New Mexico border. In September of 2014 sustained storm events produced a significant flood event in the draw that resulted in a release of petroleum products and brine fluids from oil industry infrastructure. Flood waters overran the COG Operating LLC Crossman 25 State #1H well pad and washed tanks, equipment and a portion of the pad downstream resulting in the reported release of 280 bbl oil and 100 bbls produced water with no recovery. A Mewbourne Oil Company salt water disposal line that ran alongside the west side of the Highway 285 bridge was damaged within the draw by floodwaters and debris and resulted in a reported release of 253 bbls oil and 1,473 bbls of produced water (253 bbls oil and 267 bbls produced water / flood water were reported recovered). In October 2014 a Yates Petroleum Corporation buried salt water disposal line ruptured on the south bank of the draw. Yates reported that 20 bbls oil and 500 bbls of produced water were released while 15 bbls oil and 375 bbls of produced water were recovered.

GL Environmental Inc. completed a site survey combined with a sampling and analysis effort of the affected portions of the draw in May and June 2015 and drafted a characterization report based on the results. This remediation plan is based on the findings of the characterization study. Observed conditions were not homogeneous throughout the release area and it was therefore useful to divide the affected area into several distinct remediation areas that share common characteristics. The remediation areas include the COG Operating LLC Crossman 25 State #1H Well Pad area, COG pad to 0.3 mi west of the Highway 285 bridge and 0.3 mi west of the highway 285 bridge to 0.5 miles east of bridge. Multiple remediation options have been identified for each of the identified areas.

Chloride concentrations in surface water within the affected area are similar across sample locations and comparable with those observed in the characterization study reference area. Diesel range organics (DRO) were detected in surface water at one location within the bermed area east of the Highway 285 bridge that was in what appeared to be a relatively stagnant pool in close proximity to DRO contaminated sediments. No DRO were detected at other surface water sample locations and surface water remediation is not currently proposed.

Recommended Remedial Action Levels

New Mexico Oil Conservation Division (OCD) implements a target of 1,000 mg/kg for remediation of chlorides and a concentration target between 100 mg/kg and 1,000 mg/kg for remediation of petroleum hydrocarbons. Due to the presence of relatively permanent surface water and shallow subsurface water in areas affected by the releases, the lower standard of 100 mg/kg is recommended for remediation of hydrocarbons.

It appears likely that geologic conditions have resulted in naturally elevated chloride concentrations in the Red Bluff Draw environment. Therefore, it is not recommended that chloride concentrations alone be used to identify material for remediation. However, material excavated as part of erosion control or other remediation activity that are in excess of 1,000 mg/kg chloride should be disposed of in accordance with applicable solid waste disposal regulations.

COG Operating LLC Crossman 25 State #1H Well Pad

The COG well pad is located within the Red Bluff Draw channel and floodplain and constricts surface water flows during flood events. The resulting increased velocity of floodwaters in combination with the presence of unconsolidated fill material has led to the erosion of the pad and downstream sedimentation. The pad should be either removed or at minimum reconfigured to clear the channel and a larger portion of the floodplain to accommodate high flow events.

Soil sampling indicates that the COG Operating LLC Crossman 25 State #1H well pad material contains elevated concentrations of chloride and DRO. Analytical results of the composited surface soil sample from the pad reported 5,500 mg/kg chloride and 1,200 mg/kg DRO. Chloride concentrations were elevated at nearly all of the samples intervals within the pad. Additionally, ongoing erosion will likely act as a source of continued sedimentation and possible DRO contamination within downstream reaches of the draw. Surface soil samples collected immediately down-gradient of the pad reported detectable concentrations of DRO which may reflect contamination from the initial release or subsequent erosion of the pad.

Hydrocarbon and Chloride impacted soils removal/treatment

Additional sampling and analysis of the pad should be conducted to identify the concentrations and distribution of hydrocarbons and chloride in the pad material. Results of the sampling should be used to delineate clean fill from DRO and chloride contaminated material that should be disposed of at an appropriate facility upon excavation. Total volume of contaminated material that will need to be removed will be based on the results of the additional sampling. Unit costs associated with loading (backhoe with bucket or bucket loader), hauling and disposing of the contaminated material are presented in Appendix 4. Disposal costs at permitted landfills are in the \$30 yd^3 range. Total volume of material to be disposed of could be as high as 5,000 - 20,000 yd^3.

Solid waste debris removal

Minor amounts of solid waste consisting mainly of metal equipment debris and damaged fencing were still present in the pad area at the time of the May and June site visits. Any remaining debris should be removed and disposed of.

Erosion control measures

Removal of the pad or a significant portion of the pad will result in the formation of an extensive area of exposed soil that is denuded of vegetation within the draw channel and floodplain. Upon completion of the earth moving activity, a vegetation community should be re-established to stabilize the soils.

In the event a reconfigured pad remains in place, it should be armored with rock gabions or other appropriate measures to deflect surface flows away from the pad and minimize erosion. The pad should be built in accordance with a design based on hydraulic calculations to ensure an appropriate elevation that would avoid inundation during a 100 year storm event.

Revegetation plan

Prior to seeding the ground surface should be scarified to create microhabitat for seed germination and root growth. Reclamation areas should be drill seeded at recommended seeding rates with a

weed-free mix of native vegetation and mulched. Alternatively, seed, mulch and a tackifier could be hydraulically applied to disturbed areas (See Appendix 2. Revegetation Plan).

Noxious weed treatment

See Appendix 3 Noxious Weed Management Plan

Evaluation of alternative reclamation/remediation approaches

Proposed alternative remediation strategies of the pad area include (1) plugging and abandonment of the well and complete removal and reclamation of the pad (most costly option), and (2) reconfiguring the pad to reduce structural impediments within the draw channel and floodplain during high flow events. The pad design should include sufficient elevation and integrity to provide stability during high flow events.

Monitoring/sampling plan

Sampling and analysis of the pad area should be conducted upon completion of material removal to ensure petroleum hydrocarbon contaminated soil is removed from the site. Monitoring of the pad area should include visual inspections of the pad and downstream locations to ensure additional sedimentation is avoided during the re-establishment of a vegetation community. Additionally, soil and surface water sampling should be conducted downstream of the pad area upon completion of the remediation tasks to identify possible contamination that occurred during the dirt work activities (See Appendix 1 - Map 5).

State and Federal permits/approvals

NMOCD should be consulted on the remediation plan particularly in establishing Recommended Remedial Action Levels (RRALs).

- NM Oil Conservation Division
  Division 2-Artesia
  811 First St.
  Artesian, NM 88210
  Contact Mike Bratcher/Heather Patterson

National Pollution Discharge Elimination System (NPDES) Stormwater Pollution Prevention Plan (SWPPP) is required for all earth disturbing activities greater than one acre in size.

- U.S EPA Region 6
  Fountain Place 12th Floor, Suite 1200
  1445 Ross Avenue
  Dallas, TX 75202-2733
  Phone: (214) 665-2200

Areas within the ordinary high water mark of Red Bluff Draw may be considered Waters of the United States. Deposition of fill materials within Waters of the United States requires

acquisition of a United States Army Corps of Engineers 404 permit (USACE). It is recommended that the USACE be consulted prior to conducting pad reconfiguration activities.

- Army Corps of Engineers
  Albuquerque District
  Las Cruces Regulatory Office
  505 South Main St., Suite 142
  Las Cruces, NM 88001

Timeline for remediation

Removal or reconfiguration of the pad should be implemented immediately. A timeline should be established with benchmarks.

COG pad to 0.3 mi west of Highway 285 Bridge

Widely spaced and spotty petroleum staining, most of which was confined to vegetation, was observed within the areas above and below where the tanks from the COG well pad came to rest after the flood event. DRO were detected in the channel sediments and soils immediately down-gradient of the tanks. It appears that petroleum contamination in the stretch of the draw between the COG pad to approximately 0.3 mi west of the Highway 285 bridge is widespread but not concentrated in any identified locations. Chloride concentration in this stretch are elevated at some sample locations but the origins are likely natural.

Hydrocarbon removal/treatment

A single location is recommended for excavation of petroleum contaminated material in this remediation area. An approximate 30 ft^2 petroleum stain is located in an upland area to the north of the tank locations (Appendix 1 - Map 1). The site should be excavated to a depth that removes impacted material. Costs associated with the removal of this material will depend on the total depth of the contamination. Unit costs for loading, hauling and disposal are presented in Appendix 4. Disposal costs at a permitted landfill are in the $30 yd^3 range.

Other petroleum contamination in this stretch of the draw appears to be mostly confined to vegetation and widespread in nature with DRO detected at low concentrations in soils at only a few locations. The proposed remediation strategy for the remainder of this stretch of the draw is monitored natural attenuation. The area mentioned above is the only location recommended for mechanical removal.

Erosion control measures

Areas disturbed by the removal of the tanks were overgrown with vegetation at the time of the characterization study and present a minimal opportunity for erosion. Numerous pipeline right-of-ways and adjacent maintenance roads cross the draw at several locations and provide a source of unconsolidated material within the draw channel that is likely resulting in downstream sedimentation. Though this sedimentation is not specifically related to the storm event release,

recommended measures include implementing stormwater runoff Best Management Practices to minimize sediment loading in the draw.

Revegetation plan

Prior to seeding the ground surface should be scarified to create microhabitat for seed germination and root growth. Reclamation areas should be drill seeded at recommended seeding rates with a weed-free mix of native vegetation and mulched. Alternatively, seed, mulch and a tackifier could be hydraulically applied to disturbed areas (See Appendix 2. Revegetation Plan).

Noxious weed treatment

See Appendix 3 Noxious Weed Management Plan

An evaluation of alternative reclamation/remediation approaches

Proposed remediation strategies of this area include (1) natural attenuation of petroleum in soils, and (2) natural attenuation of petroleum products in vegetation.

Mechanical removal in this area is not recommended because it could result in additional soil/vegetation disturbance that would require revegetation and ultimately may be more detrimental than the existing widely dispersed contamination.

A monitoring/ sampling plan

Visual inspections should be conducted throughout the area and surface water and sediments should be sampled periodically from the downstream surface water location to assess the effectiveness of natural attenuation and identify subsequent mobilization of petroleum contaminated material (Appendix 1 – Map 5).

State and Federal permits

See above for potentially applicable permits/approvals.

Timeline for remediation

Remediation of the identified petroleum contamination should be implemented as soon as possible with revegetation to follow.

0.3 mi west of Highway 285 Bridge to 0.5 miles east of Bridge

Significant petroleum product deposits were observed on vegetation and surface soils in the bermed area immediately upstream (west) of the Highway 285 bridge and for 0.5 miles east of the bridge. Reported DRO concentration ranged from 53 mg/kg to 210 mg/kg in three sediment samples collected in the organic sediments of the deeper sections of the channel in this area. Additionally, DRO were detected in the sediments beneath a pool of open water approximately 0.3 miles west of the Highway 285 bridge. No DRO was detected in soil samples which suggests that widespread infiltration of petroleum products has not occurred. No DRO was detected in the surface water indicating a limited mobility of the petroleum products at the time of sample collection.

It is recommended that a fence be installed in consultation with the NM SLO and the grazing lessee. The fence should enclose the channel area throughout this section of the draw to exclude

cattle. Cattle may ingest contaminated grasses and stir up and mobilize contaminated sediments into the surface water. The fence should enclose an approximate 150 ft buffer on both sides of the channel and include any visibly contaminated areas (See Appendix 1 - Map 2). Unit cost for the installation of a 4-strand barbed fence is $4 per foot.

Additional sediment sampling

The site survey and sampling results have provided sufficient evidence to warrant further investigation within the sediments of the deeper channel areas to determine if contaminants are present at a concentration requiring remediation. Anaerobic conditions within the sediments may slow the breakdown of hydrocarbons and the presence of standing water may result in the transport of contaminants into the subsurface. Therefore, it is important to determine if contaminants are present within these areas though additional sampling. Sampling should be conducted in pools within the remediation area between 0.3 miles west of the Highway 285 bridge to 0.5 miles east of the bridge to identify possible locations with DRO concentrations in excess of 100 mg/kg. The 10 proposed sample locations are presented in Appendix 1 - Map 4.

Hydrocarbon removal/treatment options

Visible deposits of petroleum products on the ground surface within the bermed area and immediately east of the bridge should be excavated and hauled off-site for disposal. Identified areas with concentrated surface deposits are approximately 1.5 acres in size and are depicted in Appendix 1 - Map 3. Contaminated sediments should also be excavated from the channel pools within the bermed area. Unit costs associated with loading (backhoe with bucket or bucket loader), hauling and disposing of the contaminated material are presented in Appendix 4. Disposal at permitted landfills are in the $30 yd^3 range. The approximated total volume of material to be disposed is 1,200 yd^3 cubic yards.

Additionally, the large stretch of water 0.5 mi east of the Highway 285 bridge is not proposed to be fenced to allow cattle access to water. The north end of this pool has a “ring” of oil staining in the vegetation just above the waterline. This contaminated vegetation should be removed with hand tools or other low impact method and hauled off-site for disposal.

Although DRO analytical results from sediments collected downstream of the bermed area were less than 100 mg/kg, significant concentrations were identified in two of the three samples (78 mg/kg and 53 mg/kg). Ten additional sample locations are proposed in the pools within this remediation area to identify possible locations with DRO concentrations in excess of 100 mg/kg (Appendix 1 – Map 4). Identified sediments should be excavated and removed from the site. Costs associated with the removal of this material will depend on the spatial extent and total depth of the contamination.

Significant amounts of petroleum contamination in this stretch of the draw is contained in the vegetation lining the draw channel within the proposed fenced area. This contaminated vegetation should be removed with hand tools or other low impact method and hauled off-site for disposal. Up to 2 acres of vegetation are impacted by petroleum contamination in this reclamation area. Disposal costs associated with contaminated vegetation are presented in Appendix 4.

Erosion control measures

Extensive disturbed areas are present on both sides of the draw just west of the Highway 285 bridge as a result of remediation activity at the Yates Petroleum release site to the south and oil and gas infrastructure development to the north. Sediment controls such as wattles or filter fence should be installed to provide immediate stabilization of the banks and reduce sediment loading in the draw. Vegetation buffers should be established within the Yates upland release site and along the banks of the draw to create long term stability and sediment filtration of stormwater.

Upon completion of remediation activity the berms within the channel area should be removed. Removal of berms, surface petroleum deposits and sediments will result in the formation of bare areas within the draw channel and floodplain. Upon completion of the excavation activity, a vegetation community should be re-established to stabilize the soils.

If additional contaminated sediment locations are identified up and downstream of the Highway 285 bridge, temporary access roads may need to be constructed to facilitate the material removal. Roads should be constructed in a fashion that will minimize water channelization and erosion such as aligning roads at an oblique angle to hill slopes and the inclusion of water bars and water turn-outs. Upon completion of reclamation activities the roads should be scarified along the contour (perpendicular to the slope) and re-vegetated.

Revegetation plan

Prior to seeding the ground surface should be scarified to create microhabitat for seed germination and root growth. Reclamation areas should be drill seeded at recommended seeding rates with a weed-free mix of native vegetation and mulched. Alternatively, seed, mulch and a tackifier could be hydraulically applied to disturbed areas (Appendix 2. Revegetation Plan).

Noxious weed treatment

See Appendix 3 Noxious Weed Management Plan

An evaluation of alternative reclamation/remediation approaches

Proposed alternative remediation strategies of this area include a combination of several or all of the following (1) removal of petroleum deposits on the ground surface and in sediments, (2) further sampling and analysis to identify additional petroleum contamination in sediments, (3) fencing the impacted area, (4) monitoring natural attenuation of petroleum deposits in soils and sediments, (5) use of a bio-remediation agent such as Micro-Blaze that has been used in soil remediation applications. Use of these types of products would require consultation with the Army Corps of Engineers and possibly EPA Region 6.

The area enclosed by fencing (approximately 20 acres) should be maintained until monitoring/sampling of the area indicates reduced levels of hydrocarbon contamination that will not pose health impacts for domestic livestock nor to surface water down-gradient of the area. Given the relatively high paraffin content of the hydrocarbon contamination, natural attenuation could take several years to eliminate or reduce the contamination to safe levels.

A monitoring/sampling plan

Visual inspections of the disturbed areas should be conducted upon completion of remediation activities to assess the effectiveness of removing petroleum products. Inspection may be most effective during winter months when petroleum staining would be most visible. Periodic inspections should also be conducted to assess the effectiveness of erosion control and revegetation measures.

Confirmatory sampling and analysis should be conducted to ensure contaminated sediments have been removed from the bermed area and other subsequently identified channel areas. Soil and surface water sampling should be conducted up and downstream upon completion of the remediation tasks to identify possible contamination that occurred during the dirt work activities and evaluate the long term effectiveness of the remediation (Appendix 1 – Map 5).

State and Federal permits

- An EPA National Pollution Discharge Elimination System (NPDES) Stormwater Pollution Prevention Plan (SWPPP) is required for all earth disturbing activities greater than one acre in size.
- Areas within the ordinary high water mark of Red Bluff Draw may be considered Waters of the United States. Consultation with the USACE is recommended prior to conducting remediation activities.

Timeline for remediation

Remediation strategies should be implemented immediately. A timeline should be established with benchmarks.

Conclusions

It is anticipated that completion of the identified reclamation tasks will result in the remediation of the highest concentrations of contamination in the reaches of the Red Bluff Draw impacted by the releases associated with the September/October 2014 storm event. The rationale behind this plan to address the contamination impacts was based on the following priority levels: (1) ground water/surface water, (2) soils/sediments and (3) vegetation. Contaminated ground water/surface water could potentially have health impacts on human, livestock and wildlife populations; contaminated soils/sediments could potentially impact livestock/wildlife populations and environmental quality; and contaminated vegetation could potentially impact livestock/wildlife populations and environmental quality. Although the potential of impacts to ground water was not completely eliminated, the sampling results indicated minimal infiltration of petroleum product in soil, indicating a low probability of contaminants reaching the ground water table. Likewise, petroleum concentrations in surface water samples were low or not detected with chloride levels similar to background levels.

Areas of elevated contaminant concentrations in soils and sediments have been targeted for remediation which includes removal and natural attenuation. Contaminated vegetation remediation includes fencing, natural attenuation, and removal. The additional sediment sampling of the draw in the general area of the Highway 285 bridge targets an area that had limited sampling data and

that is recommended to be fenced to prevent domestic livestock access until a more complete characterization can be made based on the follow up sampling results.

All remediation activities should be evaluated for compliance with state and federal regulations, particularly EPA Storm Water Pollution Prevention Plans (and permits) and the Army Corps of Engineers Waters of the U.S. 404 permits. Additionally, oil/gas development and operational activities in the vicinity of Red Bluff Draw should be assessed for compliance with these Clean Water Act regulations.

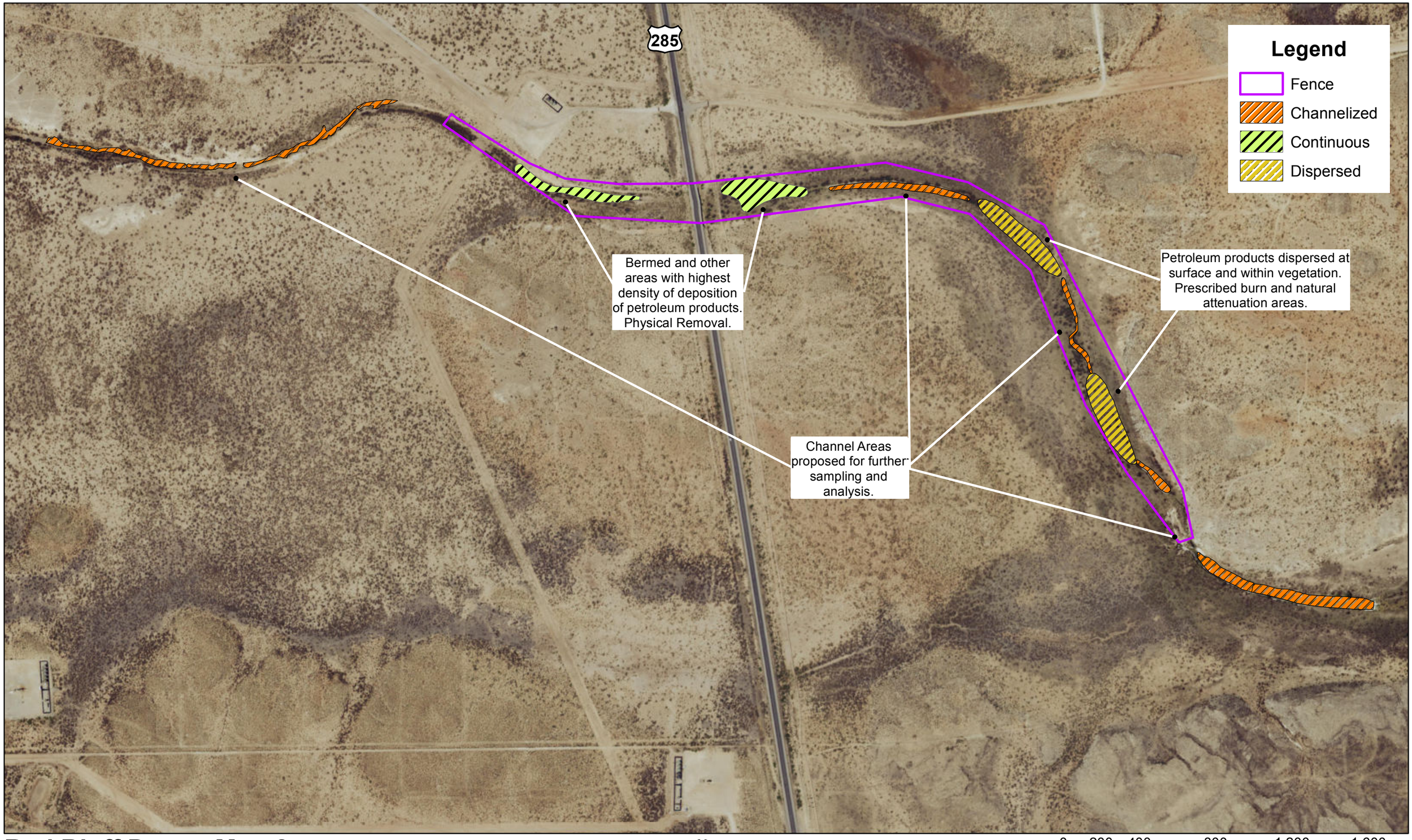
APPENDIX 1 – Maps

Red Bluff Draw - Map 1
Remediation Plan

N
W E
S

0 1,000 2,000 4,000 Feet

0 125 250 500 750 1,000 Meters



Red Bluff Draw - Map 2
Remediation Plan

N
W E
S

0 200 400 800 1,200 1,600 Feet

0 50 100 200 300 400 Meters

Red Bluff Draw - Map 3
Remediation Plan

N
W E
S

0 50 100 200 300 400
Feet

0 12.5 25 50 75 100
Meters

Red Bluff Draw - Map 4
Remediation Plan Proposed Additional Sampling

N
W E
S

Meters
0 50 100 200 300 400

Feet
0 125 250 500 750 1,000

Red Bluff Draw - Map 5
Remediation Plan Monitoring Map

N
W E
S

0 625 1,250 2,500 3,750 5,000
Feet

Meters
0 125250 500 750 1,000

APPENDIX 2 – Revegetation Plan

Revegetation Plan

The objective of the revegetation plan is to establish a healthy native plant community that will control erosion, reduce visual impacts, restore habitat and forage, and impede the invasion of noxious weeds.

Site preparation

Areas targeted for revegetation should be re-contoured and protected from erosion. Disturbed areas should be graded to a maximum 3:1 slope and blended with the surrounding topography. Low berms may need to be incorporated on the reclaimed surfaces in key locations to limit watershed size, disperse surface water and promote infiltration.

Planting

Seeding should consist of drill seeding or hydroseeding of the approved seed mix and seeding rate to the revegetation area. Certified weed free mulch should be crimped into the seeded soils at a rate of 2 tons per acre or a wood fiber mulch should be hydraulically applied to the area at a rate of 1 ton per acre. Seeding and mulching of the site should take place in either early summer to take advantage of summer monsoonal moisture or late fall.

Seed Mix

The proposed seed mix is based on soils and field observations.

Seed Mix and Application Rate Table

Common Nane	**Scientific Name**	**Pls/Lbs/Acre**
Sand Dropseed	*Sporobolus cryptandrus*	2.00
Little Bluestem	*Schizachyrium scoparium*	1.00
Plains Coreopsis	*Coreopsis tinctoria*	2.00
Plains Bristlegrass	*Setaria vulpiseta*	2.00
Sideoats Grama	*Bouteloua curtipendula*	3.00
Blue Grama	*Bouteloua gracilis*	1.50
Alkali Sacaton	*Sporobolus airoides*	1.00
Four-wing Saltbush	*Atriplex canescens*	2.00

Monitoring

Revegetated areas should be inspected annually to identify excessive erosion or failure of plant re-establishment. Identified deficiencies should be addressed in timely manner.

APPENDIX 3 – Noxious Weed Management Plan

Noxious Weed Management Plan

Successful revegetation of a native vegetation community is a crucial component needed to control noxious weeds. Once established, native vegetation has the potential to out-compete some noxious weed species. Any disturbed sites should be reclaimed and seeded as soon as possible to enable native vegetation to become established.

All contractor vehicles and equipment should be cleaned prior to beginning remediation and revegetation work to reduce the chance of introducing noxious weeds into an area. Additionally, mulch and seeds used in revegetation efforts should be weed free.

Upon completion of reclamation, noxious weed monitoring should be implemented. In the event that large infestations occur or reoccur the area(s) may need to be restored with a mechanical or herbicide treatment followed by re-seeding.

Broad application of herbicides may hamper the reestablishment of native species during revegetation efforts. For this reason, treatment methods other than herbicide application, such as mechanical and manual methods should be given greater consideration. Equipment should be used to mow or disk weed populations prior to seed head development. Subsequent seeding with an appropriate seed mix should be conducted as soon as possible following soil disturbance to re-establish a stabilizing vegetation cover and slow the potential re-invasion of noxious weeds.

Herbicide application may be used to remove or reduce noxious weed populations in areas that contain an infestation of weeds that dominate the native species where access by mowing / disking equipment is not possible or would create excessive disturbance to the existing plant community. Applications should be controlled to avoid impacts to surface water and surrounding native vegetation. A follow-up seeding program should be implemented upon the completion of vegetation removal.

New Mexico Noxious Weed Species List

Common Name	Scientific Name	State Noxious Status
Russian knapweed	*Acroptilon repens*	B
jointed goatgrass	*Aegilops cylindrica Host*	C
	Alhagi maurorum Medik.	
camelthorn	*Alhagi pseudalhagi*	A
onionweed	*Asphodelus fistulosus L.*	A
hoary cress	*Cardaria draba*	A
musk thistle	*Carduus nutans*	B
purple starthistle	*Centaurea calcitrapa*	A
diffuse knapweed	*Centaurea diffusa*	A
Malta starthistle	*Centaurea melitensis*	B
yellow starthistle	*Centaurea solstitialis*	A
spotted knapweed	*Centaurea maculosa*	A

New Mexico Noxious Weed Species List (Continued)

Common Name	Scientific Name	State Noxious Status
Canada thistle	*Cirsium arvense*	A
bull thistle	*Cirsium vulgare*	B
poison hemlock	*Conium maculatum*	B
field bindweed	*Convolvulus arvensis*	C
teasel	*Dipsacus fullonum*	B
alfombrilla	*Drymaria arenarioides*	A
Russian olive	*Elaeagnus angustifolia*	C
leafy spurge	*Euphorbia esula*	A
halogeton	*Halogeton glomeratus*	B
hydrilla	*Hydrilla verticillata*	A
black henbane	*Hyoscyamus niger*	A
dyer's woad	*Isatis tinctoria*	A
perennial pepperweed	*Lepidium latifolium*	A
Dalmatian toadflax	*Linaria genistifolia*	A
yellow toadflax	*Linaria vulgaris*	A
purple loosestrife	*Lythrum salicaria*	A
Eurasian watermilfoil	*Myriophyllum spicatum*	A
Scotch thistle	*Onopordum acanthiu*	A
African rue	*Peganum harmala*	B
saltcedar	*Tamarix*	C
Siberian elm	*Ulmus pumila*	C

- Class A species are currently not present in New Mexico, or have limited distribution. Preventing new infestations of these species and eradicating existing infestations is the highest priority.

- Class B species are limited to portions of the state. In areas with severe infestations, management should be designed to contain the infestation and stop any further spread

- Class C species are wide-spread in the state. Management decisions for these species should be determined at the local level, based on feasibility of control and level of infestation.

APPENDIX 4 – Costs

Unit Costs

Due to the potential for a wide variance in volumes of contaminated material in the three remediation areas, total cost estimates were not made. However, where possible, volumes/acreages were estimated and unit costs associated with the recommended remediation procedure are provided. The schedule of costs was obtained from local contractors in the Carlsbad/Artesia area. The landfill disposal costs are quotes from the two permitted, co-located landfills, R360 and Lea Land.

Reclamation Tasks and Unit Costs

Reclamation Area	Material excavation and disposal	Vegetation removal and disposal	Fencing
COG Operating Pad	5,000 - 20,000 yd^3	none	none
COG Pad to 0.3 mi. west of bridge	1 - 3 yd^3	none	none
0.3 mi. west of bridge to 0.5 miles east of bridge	1,200 yd^3*	~ 2 acres	7,400 ft

* acres of impacted area x 30% coverage x 0.5 ft depth

Reclamation Task	Per unit cost ($)
disposal petroleum/salt contaminated soil/vegetation - R360 Landfill ($/$yd^3$)	31 (discount over 1,000 yd^3)
disposal petroleum/salt contaminated soil/vegetation - Lea Land, Landfill ($/ton)	22
labor ($/hr)	40
backhoe ($/hr)	95
track hoe ($/hr)	165
12yd dump ($/hr)	90
12yd dump ($/hr)	105
loader ($/hr)	131
D6 Dozier ($/hr)	135
fence installation ($/ft.)	4